

7. FIRE PROTECTION

The fire protection organization and fire protection systems at the Mixed Oxide (MOX) Fuel Fabrication Facility (MFFF) provide protection against fires and explosions based on the principal and non-principal structures, systems, and components (SSCs) and defense-in-depth practices described in this chapter. Fire barriers and certain detection and suppression features are considered principal SSCs as described below.

7.1 FIRE PROTECTION ORGANIZATION AND CONDUCT OF OPERATIONS

7.1.1 Fire Protection Program

In support of operations, a fire protection program will be established for the MFFF, which will establish the fire protection policies for the MFFF site. The objectives of the fire protection program are to prevent fires from starting and to detect, control, and extinguish those fires that do occur.

The responsibility for the fire protection program is assigned to a manager who has control over the various MFFF organizations that are involved in fire protection activities. This manager is assisted by personnel who are trained and/or experienced in the field of fire protection. The fire protection organization is responsible for the following:

- Fire protection program and procedural requirements
- Fire safety considerations
- Maintenance, surveillance, and quality of the MFFF fire protection features
- Control of design changes as they relate to fire protection
- Documentation and recordkeeping as they relate to fire protection
- Fire prevention activities (i.e., administrative controls and training)
- Organization and training of the fire brigade
- Prefire planning.

Organizational responsibilities, lines of communication, and personnel qualification requirements are defined in the fire protection program. An organization chart defining the fire protection organization responsibilities and lines of communication will be provided in the license application for possession and use of special nuclear material (SNM).

7.1.2 Administrative Controls

Administrative controls are used to maintain the performance of the fire protection systems and delineate the responsibilities of MFFF personnel with respect to fire safety. The primary fire safety administrative controls are those that relate to fire prevention. These fire prevention controls, in the form of procedures, primarily control the storage and use of combustible materials combined with the use and control of ignition sources. These controls include, but are not limited to, the following:

- Governing the handling of transient combustibles in buildings containing principal SSCs, including work-generated combustibles.

- Implementing a permit system to control ignition sources that may be introduced by welding, flame cutting, brazing, or soldering operations.
- Ensuring that the use of open flames or combustion-generated smoke for leak testing is not permitted.
- Conducting formal periodic MFFF fire prevention surveillance inspections to (1) ensure that transient combustibles in areas containing principal SSCs adhere to established limits (based on the Fire Hazard Analysis [FHA]); (2) ensure the quality (e.g., availability and acceptable condition) of fire protection systems/equipment, fire stops, penetration seals, and fire-retardant coatings (if any); and (3) ensure that prompt and effective corrective actions are taken to correct conditions adverse to fire protection and preclude their recurrence.
- Performing periodic housekeeping inspections.
- Implementing a permit system to control the disarming of MFFF fire detection or fire suppression systems, including appropriate compensatory measures.
- Implementing MFFF fire protection system testing, inspection, and maintenance procedures. These procedures will include an MFFF penetration seal tracking program to record pertinent information regarding the emplacement and modification of fire barrier penetration seals that are principal SSCs.

Finally, since fires at the MFFF are possible, the actions to be taken by MFFF personnel in the event of a fire and the strategies for fighting fires will be established in a fire emergency action plan and prefire plans, respectively. The fire emergency action plan will include requirements for training, periodic drills, and exercises to verify the adequacy of the action plan.

7.2 FIRE PROTECTION FEATURES AND SYSTEMS

The fire protection SSCs at the MFFF consist of the SSCs of fire detection and suppression, life safety, and fire fighting functions to control and extinguish possible fires. For facility design and operational purposes, the MFFF is subdivided into fire areas. Fire areas are separated from other fire areas by a minimum of two-hour-rated fire barriers. The primary structural members surrounding fire areas have a minimum fire rating of two hours or greater, if required, based on the FHA. The fire barriers surrounding fire areas include the walls, ceilings, cementitious grouting (when used for horizontal or vertical penetration seals), doors, hatches, fire dampers, and mechanical and electrical penetrations of the spaces to ensure that confinement of these areas is maintained in the event of a fire. Fire areas that include grated assemblies are treated as a single fire area; the areas above and below the grated area are part of the same fire area. Fire areas are provided with fire detection, suppression, and separation in accordance with occupancy classifications and levels of hazards determined in the FHA. Appendix A of the FHA delineates specific reasons why areas of the MFFF are not provided with automatic fire suppression. Automatic suppression is not installed in the airlocks due to low fire loading. Automatic suppression is not installed in the rod handling areas due to low fire loading and limited quantity of combustible materials.

7.2.1 Functions

The functions of the MFFF fire protection features and systems are to detect fires throughout the MFFF and to control and/or extinguish possible fires throughout the MFFF.

7.2.2 General Facility Design

The MFFF buildings are constructed of noncombustible or limited combustible materials of construction. Buildings at the MFFF in which radioactive materials are to be used, handled, or stored are of Type I or Type II construction in accordance with the applicable requirements of National Fire Protection Association (NFPA) 220-1995. Buildings at the MFFF containing principal SSCs are of Type I construction in accordance with NFPA 220-1995. The Occupancy Classification for the MFFF buildings is determined using the applicable requirements of NFPA 13-1996. The fire protection of these buildings is in accordance with the applicable provisions of NFPA 801-1998 and the guidance of U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 3.16 (January 1974).

Exposed interior walls or ceilings (including ceilings formed by the underside of roofs) and factory-installed facing material will have an Underwriters Laboratory (UL)-listed or Factory Mutual (FM)-approved flame spread rating of 25 or less and a smoke developed rating of 50 or less in accordance with American Society for Testing and Materials (ASTM) E-84-98. If determined to be necessary, carpets and rugs used at the MFFF site will be tested in accordance with NFPA 253-1995.

The use of combustible materials is restricted to minimize the fire loading of each fire area. Electric cable either is run in conduit or is plenum-rated or Institute of Electrical and Electronic Engineers (IEEE) 383-1992 tested fire-resistant cable as necessary.

A provision of NFPA 801-1998 stipulates either the use of noncombustible materials in glovebox construction or implementation of equivalent levels of fire protection by other means. The industrial-scale process gloveboxes in the MFFF utilize polycarbonate as their window material, which has been evaluated to be the most appropriate material in terms of constructability, operability, and confinement performance under mechanical loading (e.g., shock, earthquake). An equivalent level of fire protection for polycarbonate glass is achieved due to the following: (1) the difficulty for polycarbonate to ignite or sustain combustion, (2) the absence of significant ignition sources in the vicinity of the glovebox windows, and (3) the fire protection features implemented for the rooms containing these gloveboxes. Additionally, most of the MFFF process (powder, pellets, and cladding) gloveboxes are ventilated with nitrogen for process reasons, and this also reduces the risk of fire within these gloveboxes. Note, however, for conservatism in the safety assessment (refer to Chapter 5.5.2.2), the nitrogen system is not identified as a principal SSC relied on for fire prevention in the gloveboxes. The principal SSCs relied on to mitigate the effects of fires involving gloveboxes containing material at risk are as follows: the C3 confinement system (HDE and process rooms, see CAR Section 11.4), and the fire barriers in the areas containing the gloveboxes.

Process cell fire prevention features are used to ensure that fires in the process cells are highly unlikely. This is accomplished through the control of ignition sources within the process cells,

by preventing the introduction or propagation of ignition sources from outside of the process cells by operators or external fires. Associated with the AP process, ignition sources may arise due to electrical equipment, static electricity, and as a result of some chemical reactions. The presence of these three ignition sources within the AP Process Cells is prevented through the following features:

- No use of electrical equipment within the process cells
- Grounding of equipment within process cells
- The use of controls ensures that potential chemical reactions that may result in a fire are made highly unlikely.

During normal operations, process cell design precludes the entry of personnel that could introduce ignition sources. Provisions exist in the design for removal of process material in the event of entry of personnel into process cells (e.g., for maintenance). The use of additional administrative controls (such as fire watch, etc.) will be applied as necessary. Process cell fire barriers are designed to limit the effect of fires such that a fire external to the process cells will not affect the process cells.

Titanium is used in certain AP tanks and vessels in the form of titanium castings. Such castings are so difficult to ignite and burn that the applicable NFPA code (NFPA 481) does not include any special storage or handling requirements for such a configuration. Thus the titanium is not considered combustible and is not included as part of the fire loading in the FHA. The ISA will evaluate anticipated changes to the form in which titanium is used (e.g., as a result of repair or maintenance activities requiring grinding or welding of titanium vessels) and additional administrative controls may be established, if necessary..

The guidance provided in other parts of the NFPA code is applicable to the fire safety design of the MFFF as follows:

- Flammable and combustible liquids, including those in major combustible liquid storage areas, are stored and handled in accordance with the applicable requirements of NFPA 30-1996. For example, where flammable or combustible solvents are used, they are handled in equipment that is designed and arranged to prevent the unintentional escape of the solvents and their vapors. Process equipment handling combustible fluids is grounded to prevent hazardous accumulations of static electricity. Additionally, containment and/or drainage systems for flammable and combustible liquids will be in accordance with the applicable requirements of NFPA 30-1996, Chapter 8.
- Fire protection for laboratories meets the applicable requirements of NFPA 45-1996.
- Flammable and combustible gases are stored and handled in accordance with the applicable requirements of NFPA 50A-1999 and NFPA 55-1998.
- Protection of buildings from exterior fire exposures is in accordance with the applicable requirements of NFPA 80A-1996.
- The furnaces that are part of the MFFF processes are the sintering furnaces in the MOX Processing (MP) Area utilizing a hydrogen/argon atmosphere and a calcinating furnace in

the Aqueous Polishing (AP) Area utilizing an air/oxygen atmosphere. The fire safety for these furnaces is in accordance with the applicable requirements of NFPA 86C-1995.

- Access/egress requirements, including emergency egress routes, comply with the applicable provisions of NFPA 101-1997 and the Uniform Building Code (UBC) (1997 edition), whichever is more restrictive. In all buildings or structures, means of egress are arranged and maintained to provide free and unobstructed lighted egress from all parts of the building or structure at all times when it is occupied. No lock or fastener will be installed to prevent free escape from the inside of any building. The MOX Fuel Fabrication Building is equipped with safe havens for emergency egress. Entrance into safe havens from the MOX Fuel Fabrication Building is considered egress from the building. These safe havens allow personnel to exit the MOX Fuel Fabrication Building to a safe location under emergency conditions but temporarily detain them in the safe haven until the required security forces are assembled to monitor them out of the safe haven.
- Zirconium, which is a combustible metal present within the MFFF, is stored and handled in accordance with the applicable requirements of NFPA 482-1996. For example, the minimal quantities of zirconium swarf are collected in covered metal containers and removed daily, as a minimum, to a safe storage or disposal area. Additionally, an adequate supply of Class D extinguishing agent is kept within the area of personnel while they are working with zirconium.
- Lightning protection for the MFFF buildings that are principal SSCs is designed in accordance with the applicable provisions of NFPA 780-1997.

7.2.3 Fire Protection System Descriptions and Major Components

The fire protection systems consist of the following systems:

- Fire barriers
- Fire detection and alarm systems
- Fire suppression systems
- Fire protection water supply system
- Smoke control system.

A program of regular inspection, testing, and maintenance of MFFF fire protection equipment, in accordance with the applicable provisions of the NFPA codes, will be implemented prior to the MFFF becoming operational. Major components of the fire protection systems are described in the following subsections.

7.2.3.1 Fire Barriers

The function of the fire barriers is to separate fire areas from one another. Fire areas confine fires to their area of origin and prevent fires from spreading to adjacent areas. Structural barriers, consisting of walls, doors, windows, floors, ceilings, hatches, fire penetration seals, and ventilation dampers, are used to separate areas containing materials and processes containing fire hazards into fire areas. Utilizing the guidance provided in NFPA 801-1998, the determination of fire area boundaries is based on consideration of the following:

- Types, quantities, density, and locations of combustible materials and radioactive materials
- Location and configuration of equipment
- Consequences of inoperable equipment
- Location of fire detection and suppression systems
- Personnel safety and exit requirements (i.e., life safety).

Fire area boundaries typically are provided to separate the following:

- Manufacturing areas and radioactive material storage areas from each other and from adjacent areas
- Control rooms, computer rooms, or combined control/computer rooms from adjacent areas
- Rooms with major concentrations of electrical equipment (e.g., switchgear rooms and relay rooms) from adjacent areas
- Battery rooms from adjacent areas
- A maintenance shop(s) from adjacent areas
- Warehouses and combustible storage areas from adjacent areas
- Emergency generators from each other and from adjacent areas
- Fan rooms and plenum chambers from adjacent areas
- Office areas from adjacent areas
- Redundant trains of principal SSCs as required.

The boundaries of the fire areas are fire-rated for a minimum of two hours. Fire barrier ratings are based on designs tested in accordance with ASTM E-119 (1995 edition). The design and construction of firewalls and fire barrier walls are in accordance with the applicable requirements of NFPA 221-1997. Firewalls are constructed of noncombustible materials and maintain sufficient structural stability under fire conditions to (hypothetically) allow the collapse of structures on either side without collapse of the wall itself. Fire-rated walls/assemblies have a minimum fire rating of two hours as prescribed by applicable codes and the FHA. Structural members supporting firewalls and floors/ceilings have a fire-resistance rating equal to or greater than that of the barrier supported.

Openings in fire barriers that separate fire areas are provided with fire doors (including frames and hardware), fire dampers, and penetration seals in accordance with the applicable standards. These features have a fire-resistance rating equal to or greater than that required of the fire barrier. Where shutdown of a ventilation system is not permitted (i.e., where the loss of confinement might pose a greater threat than the spread of fire), alternative means of protecting against fire propagation (e.g., manually closed isolation dampers, duct wrapping, duct enclosure, and/or rerouting) are provided. Raceways that penetrate fire-rated assemblies are noncombustible and are provided with penetration seals. Cable trays (as well as wireways or

conduits) that enter glovebox or decanning rooms (i.e., process rooms, designated as confinement level 3B) are solid stainless steel construction. Fire doors used in fire barriers are installed and maintained in accordance with the applicable requirements of NFPA 80-1999. Fire dampers are dynamic rated and manufactured, tested, and approved in accordance with the applicable requirements of UL 555 (1995 edition). MFFF fire area drawings, provided in Figures 7-1 through 7-8a, show the conceptual fire areas and fire barriers for the MOX Fuel Fabrication Building based on the general arrangement of the MFFF.

7.2.3.2 Fire Detection and Alarm Systems

The fire detection and alarm systems are designed in accordance with the applicable requirements of NFPA 72-1996. Automatic fire detection systems are used to supplement or to actuate fire-extinguishing systems, fire dampers, and/or fire barrier devices. These systems have a central fire alarm panel located in an attended location, which has a graphical display to assist in identification and response, by the MFFF operators. These systems also provide visual/audible alarms in the appropriate parts of the MFFF based on the location of the fire. The fire alarm system provides the status of the fire detection system.

The functions of the fire detection and alarm systems are as follows:

- Actuate automatic systems controlled by the fire detection system.
- Provide annunciation of at least three separate conditions: (1) a fire alarm, (2) a supervisory alarm, and (3) a trouble signal indicating a fault in either of the first two alarms. Annunciation of each condition is separate and distinct from the other two annunciations.
- Transmit alarm signals to the Savannah River Site (SRS) fire department alarm center and Polishing Control Room.
- Provide local and area fire alarms (visual and audible) to alert facility personnel in case of an emergency.
- Provide electric supervision of all circuits with battery backup for system operation.
- Provide supervisory indications of fire protection system status, such as valve position indicators.
- Provide a history of alarms so that the sequence of alarms received can be identified.

Automatic smoke and/or heat detectors are located throughout the MFFF in accordance with the applicable requirements of NFPA 72-1996, based on the FHA. Water-flow sensors, and alarms that respond to the sensors, are provided wherever a sprinkler system is installed in accordance with the applicable requirements of NFPA 72-1996 (see Section 7.2.3.3.1 for criticality considerations). Initiating devices, such as manual pull stations, are installed throughout the facility in accordance with the applicable requirements of NFPA 72-1996, based on the FHA. Initiating circuits are capable of transmitting an alarm under circuit fault conditions of a single ground or open, or both. The system is designed such that only those areas that require evacuation are notified.

The type of detector used in a given location is based on the fire hazards in the area, the function of the detector, and the potential for false alarms. Fire detectors are installed in accordance with the applicable requirements of NFPA 72-1996. A mixture of detector types may be appropriate. Fire or smoke detectors are designed so that the detectors are located principally at room ceilings or building roofs and at intermediate levels as may be required by specific features of design and fire hazard (e.g., ventilation ducts or other obstructions). The location and required spacing of smoke detectors are determined by the applicable methods of NFPA 72-1996. Spacing is based on threshold fire size, fire growth rate, and ceiling height as described in NFPA 72-1996. The fire detection components are listed or approved by an approved listing agency (i.e., UL or FM).

The fire detection system at the MFFF monitors the facilities for fire conditions and conditions of the fire protection system. Heat and smoke detectors are used to monitor the facilities. If an area is protected by an automatic fire protection system, activation of the fire detection system provides alarms to notify the MFFF operators and the SRS fire department and also actuates the appropriate suppression system to extinguish the fire. If protected by a manual fire suppression system, activation of the fire detection system provides alarms to notify the MFFF operators and the SRS fire department so that the appropriate manual actions are taken to extinguish the fire and evacuate the affected areas. The fire detection system also provides local and remote alarms for fire conditions, and trouble alarms when the supervisory function is inoperable.

Each glovebox will be provided with a minimum of two detectors that will be a combination of smoke and/or heat detectors. Smoke detectors are generally preferred; however, in the dusty conditions that may occur within some gloveboxes containing powders, heat detectors are preferred.

7.2.3.3 Fire Suppression Systems

The fire suppression systems provide fire suppression in the form of the appropriate extinguishing agent throughout the MFFF areas. A combination of fixed suppression systems, fire hose stations, exterior hydrants, and portable fire extinguishers are used to provide fire suppression at the MFFF. A fixed suppression system is provided for a fire area, if necessary, based on the type of hazard(s) in the fire area, the impact on MFFF operation, and the potential for release of the suppression agent. Fire suppression systems for the MFFF are composed of the following:

- Water-based suppression systems (e.g., preaction, wet-pipe, dry-pipe, water spray, and deluge systems)
- Carbon dioxide systems
- Clean agent systems
- Standpipe systems
- Portable fire extinguishers.

The components, physical arrangements, and performance characteristics of each of these fire suppression systems are discussed in the following subsections. Figures 7-9 through 7-11 and 7-

13 through 7-15 illustrate some of these systems. Figures 7-1 through 7-8a show the conceptual fire suppression agent and the areas of application in the processing buildings of the MFFF.

7.2.3.3.1 Water-Based Suppression Systems

Sprinkler systems are preaction type systems, which consist of closed-head sprinklers and normally closed preaction valves, wet-pipe sprinkler systems, dry-pipe sprinkler systems, water spray systems or deluge systems. The sprinkler systems are designed in accordance with the applicable requirements of NFPA 13-1996.

Sprinklers are not used in fire areas where fissile materials are normally present. In situations where fissile materials may be present (e.g., transport of filter cartridges), the nuclear criticality safety evaluations (NCSEs) will demonstrate the acceptability of such configurations.

Precision type water suppression systems are the predominant water-based suppression system used in the MP and AP areas, the Shipping and Receiving (SR) Area, and in the Emergency and Standby Generator Buildings. A precision system is a supervised design utilizing an electrically activated precision valve operated by fire detectors. The precision type system reduces the chances of accidental discharge by requiring independent actions to allow the discharge of water. These actions are the opening of the sprinkler by heat from the fire and the opening of the precision valve by heat or smoke detectors. A method of manually actuating the precision valve is also provided.

Dry-pipe sprinkler systems will be used in the Emergency Fuel Storage Vault. A dry pipe sprinkler system is used in the Emergency Fuel Storage Vault because the area is not heated, and the temperature may drop below 40°F. A dry pipe sprinkler system uses automatic sprinklers attached to a piping system that is under air pressure. When the heat from a fire actuates a sprinkler, the air pressure is released and permits the water pressure to open the dry pipe valve. The water then flows into the piping system and out the opened sprinkler(s). The system is supervised and operation is annunciated by flow-sensing devices.

Wet-pipe sprinkler systems are acceptable for use in fire areas identified by the FHA whose occupancies are not susceptible to water damage from inadvertent operation of the sprinklers. The equipment and devices used in sprinkler systems are UL-listed or FM-approved.

Wet-pipe sprinkler systems will be used at the other buildings and areas of the MFFF whose occupancies are not significantly impacted by water damage from inadvertent operation of the sprinklers (e.g., Administration, Technical Support, Secured Warehouse, and Reagent Processing Buildings). A wet-pipe sprinkler system uses automatic sprinklers attached to a piping system containing water supplied by the firewater supply system. When heat from a fire actuates a sprinkler, water discharges immediately from the opened sprinkler(s) onto the fire. The system is supervised and annunciated through the use of flow-sensing devices.

The truck bay areas in the Shipping and Receiving Building will be equipped with an automatic deluge system. In a deluge system, all sprinklers are open at all times. When the smoke or heat from a fire actuates a fire detector, the fire detection system sends a signal to open the appropriate deluge valve. Water flows to and is discharged from all sprinklers on the piping

system. Deluge systems will be hydraulically designed and installed in compliance with the applicable portions of NFPA 13-1996 and NFPA 15-1996.

Oil-filled transformers (if any) and areas designed to collect oil leakage from diesel generators at the MFFF may be provided (as determined by the FHA) with water spray systems. In a water spray system, all nozzles are open at all times and are designed to provide a specific water discharge and distribution over the protected surfaces or area. Actuation valves are automatically actuated.

For water-based MFFF fire protection, these systems and equipment will be periodically inspected, tested, and maintained in accordance with the applicable requirements of NFPA 25-1998.

7.2.3.3.2 Carbon Dioxide Systems

Manually operated carbon dioxide fire suppression systems are provided for the MFFF gloveboxes. The carbon dioxide systems consist of portable CO₂ bottles with a hose and quick connection fitting, and the gloveboxes are equipped with fittings and piping to direct the CO₂ to the interior areas of the glovebox. The glovebox connections are equipped with a flow-restricting orifice designed to prevent overpressurization of the glovebox. The portable CO₂ bottles are located in close proximity to the glovebox to be protected. Fixed CO₂ suppression systems are not used at the MFFF.

7.2.3.3.3 Clean Agent Systems

Clean agent fire suppression systems are provided in the areas of the MFFF where the use of water is inappropriate, primarily areas containing electrical and/or electronic equipment, such as computer rooms, motor control centers (MCCs), process rooms (such as the PuO₂ buffer storage room) and spaces such as control rooms and laboratories. Figures 7-1 through 7-8a show the conceptual coverage areas of the clean agent systems in the processing buildings of the MFFF. The clean agent supply is provided by high-pressure storage containers. The clean agent systems are designed to activate automatically by detectors. The design and installation of clean agent fire suppression systems and equipment comply with the applicable requirements of NFPA 2001-1996. The equipment and devices used in clean agent suppression systems are UL-listed or FM-approved.

The fuel cladding material (zircaloy) used in the MP process is extremely sensitive to halogenated materials (i.e., causes surface corrosion); therefore, only halogen-free clean agents are used in the MFFF.

7.2.3.3.4 Standpipe Systems

The standpipe systems provide for manual fire protection capabilities throughout the MFFF. For the MP, SR and AP Areas, a dry standpipe system (in lieu of a normally pressurized wet standpipe system) has been selected as an additional protection feature with respect to the prevention of criticality. The standpipe systems for the MFFF are designed for Class II service, which allows use by both fire fighters and facility personnel (with appropriate training).

Installation of standpipe and hose systems complies with the applicable requirements of NFPA 14-1996 for Class II service. The safe egress for personnel operating hose lines is taken into account when locating hose stations. Spray nozzles with shutoff capability that are UL-listed or FM-approved for use on electrical equipment are provided on hoses located in areas near energized electrical equipment.

Wet standpipe systems provide manual fire protection for MFFF areas other than the MP, SR and AP Areas.

7.2.3.3.5 Portable Fire Extinguishers

In addition to CO₂ bottles discussed in 7.2.3.3.2, portable fire extinguishers are provided throughout the MFFF and inside all buildings to provide the occupants the ability to extinguish fires during their incipient phase. Fire extinguishers are selected and located based on the fire hazards, the equipment in the area, and normal access and egress routes. To meet the principles of maintaining personnel radiation exposure as low as reasonably achievable (ALARA), portable fire extinguishers are not provided in MFFF rooms that are expected to have high radiation levels. The Rod Assembly Storage/handling area as shown in Figure 9-1 are high radiation areas. Response to fires in these areas will be by trained individuals. Portable fire extinguishers are positioned, installed, inspected, and maintained in accordance with the applicable requirements of NFPA 10-1998.

The portable extinguishers are distributed as a function of their effectiveness in fighting fires in the area. The portable fire extinguishers are primarily multipurpose dry chemical A, B, C type. Metal fire extinguishers (Class D) are provided in areas where cladding material could result in a metal fire, and CO₂ extinguishers are provided in areas that contain energized electrical equipment.

7.2.3.4 Fire Protection Water Supply System

The fire protection water supply system, which is primarily an underground firewater loop around the MFFF site, provides the pressure barrier to convey fire protection water to the MFFF yard hydrants and to the aboveground MFFF water-based fire protection systems. The yard fire hydrants are located around the MFFF for use by fire fighters. The fire main and water supplies are sized in accordance with the applicable requirements of NFPA 13-1996, 14-1996, 22-1998, and 24-1995. The system is designed to handle the largest sprinkler system demand plus 500 gpm for hose streams as a minimum.

The source of the fire protection water supply will be provided by SRS, subject to analysis that demonstrates the SRS firewater supply is sufficient for MFFF needs with respect to flow rate, pressure, and quantity. Figure 7-24 shows the conceptual layout of the fire protection yard loop for the MFFF.

The present F-Area firewater system at SRS is maintained by three 2,500-gpm pumps, which are capable of supplying 120-psi water pressure. One of the pumps is electric-driven, and the other two pumps are diesel-driven. Two 500,000-gal (1,892,500-L) firewater storage tanks supply the pumps.

If needed to supplement the SRS firewater supply, dedicated firewater storage and distribution systems may be used. If needed, firewater storage tanks will comply with the applicable requirements of NFPA 22-1998 and will be capable of providing the density, residual pressure, and duration specified by the applicable requirements of NFPA 13-1996. If needed, fire pumps and pressure maintenance (jockey) pumps will comply with the applicable requirements of NFPA 20-1996.

The distribution system of the firewater supply system is composed of the necessary piping, valves, flow and pressure control equipment, and instrumentation and controls to provide a reliable source of fire protection water for fighting postulated onsite fires. Piping for distribution systems is sized hydraulically using NFPA codes. The firewater distribution systems also meet the following:

- Underground firewater mains, including valves, hydrants, fire department connections, and fittings, are installed, flushed, and tested in accordance with the applicable requirements of NFPA 24-1995.
- Fire mains (except those supplying a single hydrant or extensions of existing smaller mains) are at least 8 in (20.3 cm) in diameter. Mains are sized to supply the largest fixed fire suppression system(s) demand, including the hose stream allowance, in accordance with the applicable requirements of NFPA 13-1996, with consideration for residual sprinkler system pressure requirements.
- Lines or subsystems handling water for fire protection where water flow is "off" or restricted for extended periods have a minimum earth cover in accordance with the applicable requirements of NFPA 24-1995. Any above-grade fire protection lines that are subject to freezing are insulated, heat traced, or in some other manner protected against freezing.
- Valve boxes for curb box type valves are provided in accordance with the applicable requirements of NFPA 24-1995.

7.2.3.5 Smoke Control System

Smoke control systems prevent the spread of smoke and combustion gases during a fire and remove the smoke and combustion gases after a fire has been extinguished. The smoke control system is provided using the heating, ventilation, and air conditioning (HVAC) system and includes fire dampers to control smoke and combustion gases during and following a fire. Smoke control systems for personnel occupied areas will be assessed in the FHA. The preferred smoke removal method is to use the normal ventilation system. Impacts on the ventilation system are discussed in Section 11.4.

7.2.3.6 Other Fire Protection Features and Systems

Due to the operations that occur at the MFFF, the fire protection features and systems that are related to some of these operations are distinct (e.g., limitations on sprinkler systems where criticality prevention is a concern). Other features included in the MFFF design are as follows:

- Fire safety features in C3 areas related to gloveboxes (e.g., minimization of combustible materials, use of inerting systems, capability to inject CO₂, and glovebox ventilation dampers)
- Drainage and holdup systems of firewater following a fire in C2 areas.

Details regarding these features will be available as the design of these features is finalized. Noncombustible storage racks within the MFFF are used for the storage of plutonium oxide, uranium oxide, or mixed oxide in powder, pellet, or rod form. Additionally, the areas where these storage racks are located are free of combustible material storage.

A nonflammable hydrogen/argon mixture is utilized in the MP Area within the sintering furnaces. Prior to being mixed with argon, the hydrogen is contained in high-pressure tube trailers that are situated in the Gas Storage Area. The hydrogen is mixed with the argon in the Gas Storage Area. This mixture is controlled and isolated as appropriate. The long axis of these tube trailers is parallel to the MP Area, as well as the other MFFF processing areas.

7.2.4 Basic Operation and Control Concepts

7.2.4.1 Fire Detection and Alarm System

In the event of a fire at the MFFF, the fire detection and alarm systems sense a fire condition by either smoke and/or heat detectors and notify the operators in the Polishing Control Room and the SRS fire department via the alarm system. The fire detection system provides for audible and visual alarms upon sensing smoke, heat, or the operation of a suppression system control valve. Fire alarms are provided throughout the affected building and at the Polishing Control Room. The detection system also activates the suppression system in the fire area if it is an automatic system and automatic fire dampers, as necessary. Additionally, the detection system activates the glovebox process fire doors. Those suppression systems automatically actuated by the fire detection system are operated by the activation of at least two detectors in the fire area, depending on the fire area.

7.2.4.2 Fire Barrier System

In the event of a fire, the fire barriers prevent the fire from spreading from one fire area to another. The operation of fire dampers is discussed along with the ventilation system in Section 11.4. Redundant principal SSC systems and components that are required to function during or after a fire are separated by fire barriers that are sufficient to ensure that a fire in one train of principal SSC equipment will not affect the operation of the redundant train, even if fire suppression systems fail to operate. The fire protection principal SSC separation criterion is used in the evaluation of each fire area in the FHA. Configurations where fire barriers do not separate redundant principal SSC will be identified and justified.

Automatic fire dampers, when their actuation will not compromise the operation of the confinement system, are provided in the supply ductwork. If automatic fire damper actuation could compromise the confinement system, operators control supply-side fire dampers.

Manually operated fire dampers are provided in the process room exhaust ductwork where it passes through fire barriers.

7.2.4.3 Fire Suppression System

Figures 7-9 through 7-11 and 7-13 through 7-15 illustrate the fire suppression systems for the MFFF. A fire suppression system is shut down for maintenance by manually closing the appropriate system isolation valve(s).

7.2.4.3.1 Water-Based Systems

In the event of a fire in an area protected by a wet-pipe sprinkler system, the heat from the fire opens one or more sprinklers and water is automatically discharged onto the fire. Water flow through an open sprinkler initiates a flow alarm. After the fire is extinguished, manipulation of an isolation valve stops flow. After the opened sprinklers are replaced, opening the isolation valve restores the system to an operable status.

In the event of a fire in an area protected by a preaction sprinkler system, the heat and/or smoke from a fire first actuates the detection system, which opens the preaction valve to allow water to flow into the system. A fire alarm is provided when the detection system is actuated, and a water-flow alarm is provided when the preaction valve opens. When the heat from a fire increases, one or more sprinklers open and water is discharged onto the fire through the open sprinklers. After the fire is extinguished, closing the preaction valve isolation valve stops water flow. After the system is drained and the opened sprinklers are replaced, the preaction valve is reset, the piping downstream of the preaction valve is repressurized with air, and the preaction valve isolation valve is opened.

In the event of a fire in an area protected by a dry-pipe sprinkler system, the heat from the fire opens one or more sprinklers, the compressed air in the system escapes allowing water pressure to open the dry pipe valve, and water is discharged onto the fire through the open sprinklers. Water flow through the system initiates a flow alarm. After the fire is extinguished, the isolation valve is manually closed to stop the water discharge. The system is restored to an operable status by replacing the opened sprinklers, draining the piping, reclosing the dry-pipe valve, pressurizing the system with air, and opening the isolation valve.

In the event of a fire in an area protected by an automatic deluge sprinkler system or water spray sprinkler system, the smoke or heat from a fire actuates a fire detector which alerts the operators in the Polishing Control Room. For an automatic deluge sprinkler system, a fire controller will open the appropriate deluge valve upon detection of a fire. For a water spray sprinkler system, an operator will open the appropriate isolation valve upon detection of a fire. When the valve opens, water flows to and is discharged from all sprinklers on the piping system. After the fire is extinguished, closing the valve stops water flow.

7.2.4.3.2 Carbon Dioxide Systems

In the event of a fire in a glovebox, assuming that no operators are in the affected room, the smoke/heat from a fire is detected by the fire detection system, which alerts the operators in the Polishing Control Room. Operators trained to respond to glovebox fires then manually connect

specially configured portable CO₂ bottles to the affected glovebox and actuate the bottles without impact to confinement. After the fire is extinguished, the portable CO₂ bottles that have been used are replaced with fully charged bottles. The use of manually connected portable CO₂ bottles is sufficient since there are minimal ignition sources and low fire loading within the gloveboxes. In addition, fire detectors in gloveboxes provide an early indication of potential fire conditions within a glovebox.

7.2.4.3.3 Clean Agent Systems

In the event of a fire in an area protected by a clean agent system, the smoke/heat from a fire is detected by the fire detection system, and an audible and visual predischage signal alerts personnel in the room to evacuate and provides adequate time for evacuation. The system then actuates, discharging the contents of the clean agent bottles into the affected space. The supply ventilation to the room is automatically secured prior to or simultaneous with the injection of clean agent. After the fire is extinguished, the clean agent reservoirs are refilled.

7.2.4.3.4 Standpipe Systems

It is not expected that the standpipe systems will be utilized. However, if standpipe systems are utilized, fire department members and properly trained operators operate the standpipe systems closest to the fire. For the standpipe systems that are normally dry, operation of the system requires the opening of an isolation valve. After the fire is extinguished, the standpipe water supply is secured and the standpipe and fire hoses are drained and restored for future use.

7.2.4.3.5 Portable Fire Extinguishers

In the event of a fire in an MFFF building, the person discovering the fire notifies the operators in the Polishing Control Room of the location and extent of the fire. If the fire is small and still in the incipient phase, the person may then use a portable extinguisher located nearby to attempt to quickly extinguish the fire. After the fire is extinguished, the fire extinguisher is replaced or recharged.

7.2.4.4 Fire Protection Water Supply System

The fire protection water supply system is normally in a passive mode awaiting demands on the system. When activated, the fire protection water supply system supplies water to fire hydrants, sprinkler systems, and hose stations as required.

7.2.4.5 Smoke Control System

The smoke control system works in close association with the fire barriers to prevent smoke and combustion gases from traveling through a facility rapidly. Maintaining adjacent areas free of smoke and combustion gases is important to ensure that egress routes are maintained.

Within the MP and AP Areas, the ventilation systems provide for smoke control during a fire as follows:

- The safe havens, when in use (e.g., an evacuation due to a fire), have their own dedicated HVAC system that will keep the safe havens and the associated corridors from the safe havens to the stairwells (if any) at a positive pressure with respect to surrounding building areas.
- The stairwells are normally maintained at a slightly negative pressure in relation to the safe havens.

Therefore, in the event of a fire, the pressure cascade from the safe havens to the stairwells ensures that the smoke infiltration during a fire in the MP or AP Area is minimized.

7.2.5 Interfaces

The MFFF fire protection systems interface with the following SSCs:

- **SRS fire protection water distribution system** – The SRS fire protection water distribution system provides water to the MFFF underground firewater loop.
- **SRS fire detection and alarm system** – The MFFF fire protection system control, supervisory, and alarm devices are wired to the SRS fire detection and alarm system, which will notify the SRS fire department in the event of a fire alarm.
- **Security systems** – The MFFF fire protection system control, supervisory, and alarm devices are wired to the CAS and SAS. This provides indication to security, which will be involved with the assessment, evacuation and response to fires within the Material Access Area.
- **HVAC systems** – HVAC systems include fire dampers to assist in the control of possible fires. Airlocks providing access into process rooms are ventilated by supply and exhaust ducts that are independent of the supply and exhaust ducts for the process room itself and are typically separated from the process rooms by fire-rated barriers (as shown on Figures 7-1 through 7-8a). This design allows the ventilation of the airlock to be maintained even in the event of a pressure perturbation in the process room. Airlocks are used for personnel and equipment access from one confinement zone to another. The airlock consists of a minimum-leakage door and is ventilated by the highest adjacent confinement zone ventilation system (i.e., a C2/C3 airlock is ventilated by the HDE system). (Refer to Chapter 11.4 for additional HVAC system details.)
- **Nitrogen system** – The nitrogen system (included for process reasons) at the MFFF also assists the fire protection systems by providing an inert atmosphere in a majority of the MFFF process gloveboxes during normal operations. Use of nitrogen in lieu of air minimizes the potential for a possible fire initiating within these gloveboxes. Note, however, for conservatism in the safety assessment (refer to Section 5.5.2.2), the nitrogen system is not identified as a principal SSC relied on for fire prevention in the gloveboxes.
- **Gloveboxes** – The fire protection systems provide extinguishing systems to gloveboxes throughout the MFFF.
- **Facility structures** – The facility structures include structural boundaries that also serve as fire-rated barriers.

- **Electrical Systems** – The electrical systems at MFFF assist the fire protections systems through design features providing separation, non-combustible enclosures and physical separation including cable and wire insulation fire resistance design, cable tray construction, cable and cable tray separation, transformer design and electrical panel design.
- **Lighting Systems** – The lighting systems provide for emergency egress lighting required for life safety requirements.
- **Communication Systems** – Dedicated telephone lines will be provided from MFFF Fire Alarm System to SRS Operations Center. Fire alarms (which are part of the paging and public address systems) will be provided for the MFFF control room operators and/or Operations Support Center personnel. Fire alarm system telecommunications (which include fire alarm panel network and MFFF firefighters telephone system) will be provided for use during emergency conditions

7.3 MANUAL FIRE FIGHTING CAPABILITY

The MFFF baseline needs assessment establishes the minimum necessary capabilities of the MFFF fire fighting forces. The following topics are covered in the assessment:

- Minimum staffing of the MFFF fire fighting forces
- Organization and coordination of onsite and offsite fire fighting resources
- Personal protective and fire fighting equipment
- Training of MFFF fire fighting forces
- Prefire emergency planning.

The MFFF baseline needs assessment determined that an emergency response team (i.e., the MFFF fire brigade) is required at MFFF. Although the SRS Fire Department capabilities are adequate to respond to any fire emergency at the MFFF, the need to respond to a fire emergency in a timely manner and still maintain adequate security at the MFFF required the services of an onsite emergency response team. The team will be created in accordance with NFPA 600-1996.

7.4 FIRE HAZARD ANALYSIS

The FHA for the MFFF will document the specific fire hazards, fire protection features proposed to control those hazards and the adequacy of MFFF fire safety. The FHA provides information for each fire area and describes operational concerns that can affect fire safety in the MFFF. Additionally, a thorough systematic analysis of the fire potential at the MFFF ensures that adequate fire barriers and fire protection features are incorporated into the MFFF design.

The performance of the FHA divides the MFFF into fire areas and evaluates the fire safety of each fire area and of the MFFF as a whole. Once the fire area determination is completed, the fire barriers surrounding each fire area are identified. Each fire area is then analyzed to determine the fire risks (i.e., combustibles and ignition sources) present. Principal SSCs are provided as needed to satisfy the safety function specified by the Safety Assessment of the Design Basis in Chapter 5 in each fire area. Along with this information, the planned fire

protection systems (i.e., detection, suppression, and barriers) for each fire area are determined, as well as the codes and standards to be used in the design of the fire protection systems.

After these data are collected, an analysis is performed to determine the relative risks present in each fire area. The determination of risks is based on the maximum quantities of combustibles estimated to be present in the fire area and the impact of a possible fire on the principal SSCs.

To develop the design basis fire scenario(s) for each fire area, the bounding possible fire scenario(s) are determined. The determination of each bounding scenario includes an evaluation of the types of potential fires based on the combustible form (e.g., electrical insulation, furniture, etc.), the combustible type (e.g., polyethylene, polyurethane, polycarbonate), the quantities of combustible materials contained in the fire area (including an allowance for transient combustibles); fire severity, intensity, and duration; the potential hazards created; and potential ignition sources. Each postulated fire scenario includes, as necessary, a description of the characteristics associated with the possible fire(s), such as maximum fire loading, hazards of flame spread, smoke generation, toxic contaminants, contributing fuels, and ignition sources. The total heat of combustion of the nuclear material in a glovebox that potentially could be involved in any fire is considered bounded by the total heat of combustion of the hypothetical worst-case combustible load condition in the FHA, which includes additional transient material loading used as a conservative assumption. Thus, the contribution to the fire severity from the heat of combustion of the nuclear material in a glovebox is considered bounded by the fire severity modeled in the FHA (i.e., the transient load is the largest hypothetical scenario considered). Additional fire severity modeling will be performed whenever the postulated fire scenario shows less than a 20% margin between the maximum conservative fire duration and the minimum fire-resistance rating of the fire barriers. This additional fire severity modeling will demonstrate that the factor of safety is large enough to ensure that the fire-resistance rating of the fire barriers is adequate (i.e., whether the fire severity is less than 80% of the fire barrier rating or if additional controls are required to limit the fire severity). For the additional fire severity modeling, a NIST-developed software package such as FPEtool will be utilized. The consequences of each postulated fire scenario are described, which may include the impact upon principal SSCs. Finally, the adequacy of the fire protection systems of each fire area is assessed as to whether the installed fire protection is adequate to effectively control these risks.

Concerns for life safety are intrinsic to the overall review and are addressed by a determination of the adequacy of egress capabilities from each fire area.

The FHA is part of the Integrated Safety Analysis. The FHA is an ongoing process during design. During the initial phase of the ISA (Safety Assessment [SA] of the design basis), a fire safety strategy was formulated for each respective fire area of the facility. This safety strategy was based on a consequence analysis for each of the respective fire areas and an assessment of the feasibility of implementing the selected fire safety strategy for fires. To support these assumptions, a number of calculations and hazard analyses are performed to demonstrate that sufficient controls are present such that process upsets or NPH that could lead to a fire are highly unlikely or the consequence of the resulting fire does not exceed the performance requirements of 10 CFR 70.61. As previously stated, the FHA verifies the combustible loading within the process area, whether ignition sources are present, and that fires, should they occur, will remain within the initial fire area (i.e., do not propagate). Should the margin between the fire severity

determined by the FHA and the fire barrier rating fall below acceptable limits additional fire severity modeling is performed using empirically-based computational numerical models and a revised assessment is made. This information is then utilized to demonstrate that the fire barriers are not compromised, fires will not affect radioactive material within the C4/C3 confinement areas, and that the effects of a given fire will not affect the ability of the high efficiency particulate air (HEPA) filters to mitigate a release that may accompany a fire. The ISA process determines both the effectiveness and likelihood of failure of identified IROFS and performs an assessment to determine that those IROFS that are required to remain operable and effective during a fire do so. The assessments of the respective process units are summarized and documented as part of the Nuclear Safety Evaluations.

During the design and construction of the MFFF, the FHA will be updated and controlled by configuration management (as discussed in Section 15.2) to ensure that the information and analysis presented in the FHA are consistent with the current state of the MFFF. After the MFFF is declared operational, the FHA will be reviewed and updated as necessary at defined regular intervals to document that MFFF fire protection features are adequate to ensure fire safety. In addition to this periodic review/update, the FHA will be revised as needed to incorporate significant changes and modifications to the MFFF, its processes, or combustible inventories.

7.4.1 Preliminary Fire Hazard Analysis

The fire hazard analysis conducted at this phase of the design is the Preliminary Fire Hazard Analysis (PFHA). The purpose of this PFHA is to document the specific fire hazards, fire protection features proposed to control those hazards, and the overall adequacy of fire safety at the MFFF based on available design information. This PFHA consists of a preliminary analysis of the fire hazards, identification of fire areas, the initial development of design basis fire scenarios, and evaluation of anticipated consequences, resulting in a preliminary determination of the adequacy of facility fire safety.

7.4.1.1 Scope of PFHA

The PFHA evaluates the MFFF preliminary design, and the conditions and arrangements described in the PFHA are based on design documentation, drawings, and specifications. The scope of the PFHA is based on the information available at this stage of design. MFFF areas that are analyzed in the PFHA are found in Table 7-1. A detailed FHA will be generated in support of the license application for possession and use of SNM.

7.4.1.2 Methodology of PFHA

The approach taken to complete the PFHA begins with a determination of fire areas. Once the fire area determination is completed, the fire barriers surrounding each fire area are identified. Figures 7-1 through 7-8a show the conceptual fire areas and fire barriers for the MOX Fuel Fabrication Building based on the current general arrangement of the MFFF. Each fire area is then analyzed to determine the fire risks (i.e., combustibles and ignition sources) present and the principal SSCs in each fire area. Fire protection systems (i.e., detection, suppression, and barriers) for each fire area are established, as well as the codes and standards to be used in the

design of the fire protection systems. Figures 7-1 through 7-8a also show the conceptual fire suppression agent and the areas of application in the processing buildings of the MFFF.

After the information above is collected, an analysis is performed to determine the risks present in each fire area. The determination of risks is based on the maximum quantities of combustibles estimated to be present in the fire area based on MELOX data and experience.

For each fire area, the possible fire scenarios are determined. The determination of these scenarios included a review of the types of potential fires based on the quantities of combustible materials; the estimated fire severity, intensity, and duration; the potential hazards created; and ignition sources. Each postulated fire scenario includes, as necessary, a description of the characteristics associated with the fire(s), such as maximum fire loading, hazards of flame spread, smoke generation, toxic contaminants, contributing fuels, and ignition sources. Finally, the adequacy of the fire protection systems of each fire area is assessed as to whether the installed fire protection is adequate to effectively control these risks.

7.4.1.3 Assumptions of PFHA

The following assumptions apply to the PFHA:

- An administrative fire safety program is in place that limits transient combustibles and controls ignition sources.
- Polycarbonate glovebox windows will be used in the MFFF process gloveboxes.
- The fire loading of each fire area is assumed to include a conservative equivalent transient fire loading contribution of 2,600,000 Btu (2,743 MJ). This value is expected to represent a maximum transient load quantity of transient combustible material based on review of MELOX experience.
- Fire is assumed to start in one place at a time.
- For the purposes of the PFHA, quantities and types of combustibles and ignition sources in the MELOX facility are representative of the quantities and types of combustibles and ignition sources that will be found in rooms in the MP Area, AP Area, and Shipping and Receiving Area with similar functions. Table 7-1 provides a summary of estimated combustible loading and resulting fire severity within the MFFF rooms evaluated in the PFHA (severity is based on a fire load of 80,000 Btu/ft² equating to a fire severity of 60 minutes).
- To verify the adequacy of the fire resistance of the fire barriers of a given fire area, it is assumed that no suppression system functions automatically, no manual initiation of fire suppression occurs, and all combustible material in a fire area is consumed by the postulated fire.
- SRS provides an adequate supply of fire protection water to the MFFF.

7.4.2 Conclusions of the PFHA

The PFHA concluded the following:

- For most of the fire areas analyzed in the PFHA, the potential fires were typically small and non-propagating because the duration of these fires is anticipated to be short relative to the rating of the fire barriers of the fire area and the fires themselves have a low heat release rate and/or a low heat flux. These fires will have minimal impact on their surroundings within the fire area. Additionally, since the fire barriers surrounding these fire areas have a minimum fire rating of two hours, the penetrations of these barriers will be routinely inspected, and any fire doors in these barriers will be self-closing, there should be no impact of such fires on surrounding fire areas. In the unlikely event of a barrier failure (e.g., unsealed penetrations, open fire doors), any fire in these fire areas is not expected to result in propagation of the fire to other fire areas due to the limited nature of the fire.
- For those fire areas analyzed in the PFHA where the fire could involve the entire fire area (such as switchgear and MCC rooms), the barriers surrounding these fire areas (which are typically fire-rated for three hours) ensure that the effects of the fire are contained to the fire area itself. Also, the fire areas where the fire could involve the entire fire area did not include any fire areas containing dispersible radioactive materials. In the unlikely event of a barrier failure (e.g., unsealed penetrations, open fire doors), it is conceivable that the fire may propagate to an adjacent fire area. However, because the fire barrier penetrations are routinely inspected and fire doors are self-closing, the continued propagation of the fire as a result of barrier failures is doubtful. Furthermore, these fires would typically propagate into areas with low combustible loading. Propagation of the fire beyond an adjacent fire area is extremely unlikely, and a fire that propagates to a facility wide fire is judged to be incredible.
- For fires that may occur at the MFFF, the fires will be contained to their fire area of origin. To provide defense-in-depth to the fire barriers of fire areas containing dispersible radioactive materials (which are principal SSCs), the fire detection system and the fire suppression systems in these areas will be designated as principal SSCs to further ensure that a propagating fire cannot result in an unacceptable release of radioactive material to the environment. Within the MOX Fuel Fabrication Building, the fire detection system and the clean agent suppression systems (where they protect fire areas with dispersible radioactive materials) are designated as principal SSCs. Since the water-based suppression systems in the MOX Fuel Fabrication Building are not provided in fire areas that normally contain dispersible radioactive materials, they are not designated as principal SSCs.

For those fire detection and suppression systems designated as principal SSCs, the design of these systems will be in accordance with the applicable requirements of the NFPA codes, similar to other MFFF fire protection systems.

The design of the MFFF will provide multiple layers of defense against fires due to the limited fire loading, minimal ignition sources, passive fire barriers, fire detection and alarm systems,

fixed fire suppression systems, and portable extinguishing equipment. Therefore, except for the equivalencies and exceptions stated previously, the MFFF fire safety design meets the applicable requirements or intent of the NFPA standards and national building codes.

7.4.3 Evaluation of Design Changes Subsequent to PFHA

Subsequent to completion of the PFHA, six new process units were added to the facility to accommodate alternate feedstock (see Chapter 11.2 and 11.3 for detailed descriptions). The impact of these additional process units is conceptually reflected in Figures 7-1 through 7-8a with regard to updated fire area designations, fire barrier ratings, and fire suppression coverage. The information presented in these figures is based on engineering judgment and preliminary evaluation of the design of these units. As stated previously, an FHA generated in support of the license application for possession and use of SNM will demonstrate the adequacy of these fire area designations, fire barrier ratings, and fire suppression coverage.

7.5 DESIGN BASES

The design bases of fire protection at the MFFF ensure that adequate protection is provided against fires and explosions. In addition to the design basis information contained in this section, applicable codes and standards are cited in previous sections of this chapter (see Section 7.2, et al).

7.5.1 Equivalencies and Exceptions to Codes and Standards

The following design features will require approval by the Authority Having Jurisdiction as either equivalencies or exceptions to the NFPA codes:

- Safe havens are being used as areas for detaining personnel during emergency egress from the MOX Fuel Fabrication Building due to required security measures. This configuration conflicts with the impediments to egress requirements of NFPA 101-1997, Chapter 28 as written, because the delay period is longer than normally allowed. However, the use of safe havens is an acceptable exception to the NFPA codes because they have been designed to meet the intent of the applicable code requirements for areas of refuge and also provide the additional levels of protection appropriate under the "New Detention and Correction Occupancies" classification. Also, the use of safe havens affords the occupants of the MOX Fuel Fabrication Building with the highest level of protection considering the security restraints required of this building. Therefore, this exception to NFPA 101 is justified because safe havens provide a protected area of refuge while personnel are temporarily detained to meet security requirements.
- Due to criticality concerns, the standpipe system for the MP, Shipping and Receiving, and AP areas are dry, not wet, as required by NFPA 14-1996 for Class II systems. However, the use of dry standpipes is justified because the standpipe systems are not the primary fire suppression systems in these buildings and the prevention of inadvertent criticality is an important safety consideration, which is balanced with the fire suppression design requirements.

- Polycarbonate glovebox windows, which are a "combustible" as defined in NFPA 801-1998, have been selected for use in MFFF process gloveboxes. NFPA 801-1998 Section 5-4.4.1 requires the use of noncombustible materials in the construction of gloveboxes. However, as allowed by NFPA 801-1998, an equivalent level of fire protection is achieved for this material selection due to the following: (1) the difficulty for polycarbonate to ignite or sustain combustion, (2) the absence of significant ignition sources in the vicinity of the glovebox windows, and (3) the fire protection features implemented for the rooms containing these gloveboxes.
- Fire suppression has not been included in several areas of the MOX Fuel Fabrication Building. These areas include airlocks, plenums, chases, and other areas as shown on Figures 7-1 through 7-8a. Typically, these areas are not normally occupied, have low combustible loading, and/or have limited ignition sources. This configuration conflicts with the requirements of the UBC (1997 edition, Chapter 10-1003.4) that stipulates that in order to maximize the egress travel distance to the nearest exit, the building must be provided with sprinkler systems throughout. However, this configuration is considered to be an acceptable exception to the UBC because of the low risk of a fire starting or propagating in these areas, the separation of these areas from other fire areas by fire-rated barriers, and (in some cases) the inability to inspect these areas on a routine basis due to the constraints of the operations within these areas (e.g., solvent cells).
- Fire doors unique to the MOX production design and processes are not UL listed or FM approved, and therefore will not be labeled. These fire doors include the revolving fire doors of the Jar Storage and Handling (NTM) unit, and the cut-off fire doors of the Pellet Handling (PML) unit. The use of fire doors that are not UL listed or FM approved deviates from the guidance of Section 1-6.1 of NFPA 80-1999, which requires fire doors be labeled. The use of these fire doors will be qualified through additional testing to U.S. standards or equivalent method.

7.5.2 Design Basis for Non-Principal SSCs

The following criteria are generally applicable to all fire protection SSCs (some criteria are repeated in Section 7.5.3 where they constitute design bases for principal SSCs).

- A fire protection program will be established at the MFFF.
- Administrative controls will be implemented at the MFFF to monitor and maintain the performance of the MFFF fire protection systems and personnel.
- Each fire area within the MOX Fuel Fabrication Building will have fire-rated boundaries of a minimum of two hours.
- The ventilation supply to fire areas that are protected by total flooding gaseous suppression systems is automatically secured (by closure of the HVAC supply fire damper) prior to or simultaneous with the injection of the suppression agent.
- Sprinkler systems are designed in accordance with the applicable requirements of NFPA 13-1996.

- The MFFF fire main and fire water supplies are sized in accordance with the applicable requirements of NFPA 13-1996, 14-1996, 22-1998, and 24-1995.
- Flammable and combustible liquids are stored and handled in accordance with the applicable requirements of NFPA 30-1996.
- The MFFF fire detection and alarm system is designed in accordance with the applicable requirements of NFPA 72-1996.
- MFFF buildings containing principal SSCs are designed as Type I construction in accordance with the applicable requirements of NFPA 220-1995.
- An MFFF emergency response team (i.e., the MFFF fire brigade) will be created in accordance with NFPA 600-1996.
- The fire loading in each fire area of the MFFF will include a quantity of transient combustible material. For the MOX Fuel Fabrication Building, this transient fire load adds 2.6 million Btu (2,743 MJ) to the fire load of each fire area. This value is expected to represent a maximum transient load quantity of transient combustible material based on review of MELOX experience.

7.5.3 Design Basis for Principal SSCs

The fire barrier systems (e.g., walls, doors, fire dampers, penetration seals) within the MOX Fuel Fabrication Building are principal SSCs as described in Chapter 5, and have fire ratings of a minimum of two hours. The fire barrier systems contain fires within a single fire area and thus prevent a fire from spreading from one fire area to another.

Process cell fire prevention features are used to ensure that fires in the process cells are highly unlikely. This is accomplished through the control of ignition sources within the process cells, by preventing the introduction or propagation of ignition sources from outside of the process cells by operators or external fires. The use of additional administrative controls (such as fire watch, etc.) will be applied as necessary. Process cell fire barriers are designed to limit the effect of fires such that a fire external to the process cells will not affect the process cells.

Fire detection and suppression SSCs support the fire barriers as necessary but are not specifically credited in the SA with preventing or mitigating design basis events. For conservatism and defense in depth, however, detection and suppression systems within each fire area containing significant quantities of dispersible radioactive material are designated as principal SSCs to provide diverse means of mitigating the risks associated with a fire in these areas. As principal SSCs, these systems will be designed and installed to be operable after a seismic event. The MFFF fire detection and alarm system is designed in accordance with the applicable requirements of NFPA 72-1996.

In addition, the following criteria apply to specific fire protection principal SSCs:

- Fire doors that are an intrinsic part of the glovebox processes are normally closed. When the fire detection system on either side of the door senses a fire condition and the process

safety control subsystem senses an object within the collision zone of the fire door, the closing of the fire door is inhibited by the process safety control subsystem until the collision zone is clear. Otherwise, upon detection of a fire, the process safety control subsystem stops the process operations and ensures that the fire doors are closed.

- Fire dampers located in the ventilation exhaust of process rooms are capable of being manually closed, and ventilation supply will be either automatic or manual.
- MFFF buildings containing principal SSCs are designed as Type I construction in accordance with the applicable requirements of NFPA 220-1995.
- Process room ventilation exhaust will normally remain open during a fire, and the C3 dynamic confinement system (in the form of the High Depressurization Exhaust System) will ensure that any potential releases caused by a fire are filtered. Filters with fire screens are provided at each exhaust outlet from process rooms containing gloveboxes to protect the final HEPA filters. (Refer to Section 11.4 for additional details.)
- The final MDE, HDE, POE and VHD HEPA filters are qualified for the maximum temperature loading anticipated to result from credible fires within the MOX Fuel Fabrication Building. (Refer to Section 11.4 for additional details.)
- The final MDE, HDE, POE and VHD HEPA filters are qualified to maintain design flow for the maximum soot loading and maximum differential pressure anticipated to result from credible fires within the MOX Fuel Fabrication Building. (Refer to Section 11.4 for additional details.)

This page intentionally left blank.

Tables

This page intentionally left blank.

Table 7-1. MFFF Room Combustible Summary

Fire Area	Room	Room Description	MJ/m ²	BTU/ft ²	Including Transient Fire Load (BTU/ft ²)	Estimated Fire Severity (min)
FA-MP-101	B-101	Personnel & Material Corridor	317.6	27,964.7	30,332.9	23
	B-102	Personnel & Material Corridor	317.6	27,964.7	30,332.9	23
	B-103	Personnel & Material Corridor	317.6	27,964.7	30,332.9	23
	B-104	Personnel & Material Corridor	317.6	36,780.6	39,148.7	30
	B-108	Airlock	36.2	3,187.6	15,265.0	12
	B-177	Corridor	317.6	36,780.6	39,148.7	30
	B-182	Airlock	36.2	3,187.6	15,265.0	12
	B-183	Corridor	317.6	27,964.7	30,332.9	23
	B-109	Airlock	36.2	3,187.6	15,265.0	12
	B-111	Airlock	36.2	3,187.6	15,265.0	12
	B-114	Airlock	36.2	3,187.6	15,265.0	12
	B-125	Airlock	36.2	3,187.6	15,265.0	12
	B-127	Airlock	36.2	3,187.6	15,265.0	12
	B-128	Airlock	36.2	3,187.6	15,265.0	12
	B-131	Airlock	36.2	3,187.6	15,265.0	12
	B-133	Airlock	36.2	3,187.6	15,265.0	12
	B-144	Airlock	36.2	3,187.6	15,265.0	12
	B-148	Airlock	36.2	3,187.6	15,265.0	12
	B-151	Airlock	36.2	3,187.6	15,265.0	12
	B-154	Airlock	36.2	3,187.6	15,265.0	12
	B-176	Airlock	36.2	3,187.6	15,265.0	12

Table 7-1. MFFF Room Combustible Summary (continued)

Fire Area	Room	Room Description	MJ/m ²	BTU/ft ²	Including Transient Fire Load (BTU/ft ²)	Estimated Fire Severity (min)
FA-MP-105	B-122	Trolley Parking Area 1	408.6	35,979.8	37,303.3	28
	B-123	Jar Storage and Transfer				
	B-146	Trolley Parking Area 2				
FA-MP-106	B-112	Service Elevator	69.0	6,075.8	21,172.5	16
FA-MP-106	B-394	Airlock	36.2	3,187.6	15,265.0	12
FA-MP-107	B-113	Staircase	27.6	2,426.6	7,190.9	6
FA-MP-108	B-115	Sintering Furnaces	646.5	56,928.2	57,811.4	44
FA-MP-109	B-116	Access to 117	346.8	30,537.4	34,666.4	26
	B-117	Green Pellet Storage				
FA-MP-110	B-118	Airlock	36.2	3,187.6	15,265.0	12
FA-MP-111	B-119	Homogenization - Pelletizing 1	1,388.5	122,264.4	123,817.7	93
	B-120	Airlock	36.2	3,187.6	15,265.0	12
	B-121	Homogenization - Pelletizing 2	1,388.5	122,264.4	123,817.7	93
FA-MP-112	B-124	Primary Dosing	1,215.3	122,264.4	123,817.7	93
FA-MP-113	B-126	Scraps Melting, Blend Milling, & Final Dosing	1,388.5	133,148.1	134,701.5	102
FA-MP-114	B-129	Sintered Pellet Storage	346.8	30,537.4	34,666.4	26
	B-130	Access to 129				
FA-MP-115	B-132	Grinding	813.9	71,671.5	72,557.9	55
	B-140	Grinding & Scraps Box Loading				
FA-MP-116	B-134	Access to 135	346.8	30,537.4	34,666.4	26
	B-135	Scrap Storage				
FA-MP-117	B-136	Material Corridor and Transfer Tunnels	346.8	30,537.4	34,666.4	26
FA-MP-119	B-138	Airlock	52.5	4,621.0	13,247.7	10

Table 7-1. MFFF Room Combustible Summary (continued)

Fire Area	Room	Room Description	MJ/m ²	BTU/ft ²	Including Transient Fire Load (BTU/ft ²)	Estimated Fire Severity (min)
FA-MP-122	B-142	Powder and Pellet Control Room	405.0	35,660.4	46,395.8	35
	B-196	Engineer Office				
FA-MP-123	B-143	Staircase	27.6	2,426.6	7,190.9	6
FA-MP-125	B-149	Receiving Control Room	405.0	35,660.4	46,395.8	35
	B-150	Engineer Office				
FA-MP-129	B-157	Safekeg Opening & 3013 Counting	937.0	82,507.6	93,009.7	70
	B-158	PuO ₂ Storage	4.7	413.0	3,655.3	3
FA-MP-131	B-162	Staircase	27.6	2,426.6	7,190.9	6
FA-MP-136	B-167	Engineer Office	405.0	35,660.4	46,395.8	35
	B-168	Rod Area Control Room				
	B-171	Airlock				
FA-MP-137	B-169	Rod Inspection	36.2	3,187.6	15,265.0	12
	B-173	Visual and Dimensional, Inspection and Storage	227.4	20,027.3	20,436.7	16
FA-MP-141	B-175	Service Elevator	69.0	6,075.8	21,172.5	16
FA-MP-142	B-178	Assembly Area Control Room	405.0	35,660.4	46,395.8	35
	B-179	Engineer Office				
FA-MP-143	B-180	Airlock	36.2	3,187.6	15,265.0	12
FA-MP-146	B-183	Assembly Storage	104.2	9,178.1	13,453.3	11
FA-MP-149	B-187	Airlock	36.2	3,187.6	15,265.0	12
FA-MP-150	B-190	Airlock	36.2	3,187.6	15,265.0	12
FA-MP-151	B-191	Staircase	27.6	2,426.6	7,190.9	6
	B-272	Airlock	36.2	3,187.6	15,265.0	12

Table 7-1. MFFF Room Combustible Summary (continued)

Fire Area	Room	Room Description	MJ/m ²	BTU/ft ²	Including Transient Fire Load (BTU/ft ²)	Estimated Fire Severity (min)
FA-MP-201	B-201	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	B-202	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	B-203	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	B-204	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	B-205	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	B-206	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	B-207	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	B-208	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	B-234	Airlock	36.2	3,187.6	15,265.0	12
	B-236	Airlock	36.2	3,187.6	15,265.0	12
	B-273	Airlock	36.2	3,187.6	15,265.0	12
	B-277	Airlock	36.2	3,187.6	15,265.0	12
	B-228	Airlock	36.2	3,187.6	15,265.0	12
	B-255	Airlock	36.2	3,187.6	15,265.0	12
	B-209	HD Fan Train A	42.8	13,164.2	24,143.7	19
	B-210	HD Fan Train B	42.8	13,164.2	24,143.7	19
FA-MP-203	B-211	HD Fan Way 2	42.8	13,164.2	24,143.7	19
FA-MP-204	B-212	HD Fan Way 1	42.8	13,164.2	24,143.7	19
FA-MP-205	B-213	MD Fan Way 2	42.8	13,164.2	24,143.7	19
FA-MP-206	B-214	MD Fan Way 1	42.8	13,164.2	24,143.7	19
FA-MP-207	B-221	Last Level of Filtration Room	101.7	8,982.7	10,031.0	8
FA-MP-211	B-222	Airlock	36.2	3,187.6	15,265.0	12
FA-MP-212	B-223	THD 1 Fan Train A	42.8	3,770.4	14,749.8	12
FA-MP-213	B-224	THD 2 Fan Train B	42.8	3,770.4	14,749.8	12
FA-MP-214	B-225	THD 3 Fan Train A	42.8	3,770.4	14,749.8	12

Table 7-1. MFFF Room Combustible Summary (continued)

Fire Area	Room	Room Description	MJ/m ²	BTU/ft ²	Including Transient Fire Load (BTU/ft ²)	Estimated Fire Severity (min)
FA-MP-215	B-226	THD 4 Fan Train B	42.8	3,770.4	14,749.8	12
FA-MP-220	B-235	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-237	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-238	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
FA-MP-221	B-239	Access to 240	346.8	30,537.4	34,666.4	26
	B-240	Ground and Sorted Pellet Storage				
FA-MP-222	B-241	Electronic Equipment	937.0	82,507.6	93,009.7	70
FA-MP-225	B-244	Electronic Equipment	937.0	82,507.6	93,009.7	70
FA-MP-226	B-245	Electronic Equipment	937.0	82,507.6	93,009.7	70
FA-MP-230	B-249	Powder Receiving Electronics Room	937.0	82,507.6	93,009.7	70
FA-MP-231	B-250	Powder Receiving MCC Room	1,407.3	125,276	127,792.1	96
FA-MP-236	B-256	Waste Control Room	405.0	35,660.4	46,395.8	35
	B-257	Engineer Office				
	B-258	Cladding Control Room	405.0	35,660.4	46,395.8	35
FA-MP-237	B-274	Engineer Office				
	B-259	Cladding and Rod Control Electronics Room	937.0	82,507.6	93,009.7	70
FA-MP-238	B-260	Cladding and Rod Control MCC Room Way 1	1,407.3	125,276	127,792.1	96
FA-MP-239	B-261	Cladding and Rod Control MCC Room Way 2	1,407.3	125,276	127,792.1	96
FA-MP-241	B-262	Assembly Electronics Room	937.0	82,507.6	93,009.7	70
FA-MP-242	B-263	Assembly MCC Room	1,407.3	125,276	127,792.1	96
FA-MP-243	B-264	Cladding and Decadding	924.2	81,384.7	81,908.5	62
FA-MP-245	B-266	Waste Electronics Room	937.0	82,507.6	93,009.7	70
FA-MP-246	B-267	Waste MCC Room	1,407.3	125,276	127,792.1	96
FA-MP-248	B-269	Utility Chase	951.1	83,745.0	85,961.0	65

Table 7-1. MFFF Room Combustible Summary (continued)

Fire Area	Room	Room Description	MJ/m ²	BTU/ft ²	Including Transient Fire Load (BTU/ft ²)	Estimated Fire Severity (min)
FA-MP-250	B-276	Electronics Room	937.0	82,507.6	93,009.7	70
FA-MP-301	B-301	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-302	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-303	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-304	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-305	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-306	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-307	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-309	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-330	Airlock	36.2	3,187.6	15,265.0	12
	B-340	Airlock	36.2	3,187.6	15,265.0	12
	B-351	Airlock	36.2	3,187.6	15,265.0	12
	B-370	Airlock	36.2	3,187.6	15,265.0	12
	B-371	Airlock	36.2	3,187.6	15,265.0	12
	B-386	Airlock	36.2	3,187.6	15,265.0	12
	B-329	Airlock	36.2	3,187.6	15,265.0	12
	B-335a	Airlock	36.2	3,187.6	15,265.0	12
	B-346	Airlock	36.2	3,187.6	15,265.0	12
	B-348a	Airlock	36.2	3,187.6	15,265.0	12
	B-393	Airlock	36.2	3,187.6	15,265.0	12
FA-MP-303	B-310	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-311	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
	B-347	Airlock	36.2	3,187.6	15,265.0	12
FA-MP-304	B-312	Personnel and Material Corridor	317.6	27,984.7	30,332.9	23
FA-MP-307	B-317	Utilities MCC Room Way 2	1,407.3	123,923.1	126,439.2	95

Table 7-1. MFFF Room Combustible Summary (continued)

Fire Area	Room	Room Description	MJ/m ²	BTU/ft ²	Including Transient Fire Load (BTU/ft ²)	Estimated Fire Severity (min)
FA-MP-308	B-318	Utilities MCC Room Way 1	1,407.3	123,923.1	126,439.2	95
FA-MP-309	B-319	Utilities Control Room	405.0	35,660.4	46,395.8	35
FA-MP-310	B-320	Utilities Security Electronics Room	937.0	82,507.6	93,009.7	70
FA-MP-311	B-321	Utilities Normal Electronics Room	937.0	82,507.6	93,009.7	70
FA-MP-312	B-322	Pellet MCC Room Way 1	1,407.3	123,923.1	126,439.2	95
FA-MP-313	B-324	Powder MCC Room Way 1	1,407.3	123,923.1	126,439.2	95
FA-MP-314	B-325	Pellet Area Electronics Room	937.0	82,507.6	93,009.7	70
FA-MP-315	B-326	Powder MCC Room Way 2	1,407.3	123,923.1	126,439.2	95
FA-MP-316	B-327	Pellet MCC Room Way 2	1,407.3	123,923.1	126,439.2	95
FA-MP-317	B-328	Powder Area Electronics Room	937.0	82,507.6	93,009.7	70
FA-MP-323	B-337	ICP-MS	263.2	23,179.9	24,886.9	19
FA-MP-327	B-342	Gas Physics	623.9	54,933.2	58,288.0	44
FA-MP-331	B-349	Test Line	366.8	32,297.0	34,936.8	27
FA-MP-334	B-353	Electrical Room	1,407.3	123,923.1	126,439.2	95
FA-MP-335	B-354	Weak Currents and Rad Control Electrical Room	937.0	82,507.6	93,009.7	70
FA-MP-341	B-362	Emergency Train A Electronics Room	937.0	82,507.6	93,009.7	70
FA-MP-346	B-376	JO Fan 1 Way 1	42.8	3,770.4	14,749.8	12
	B-377	JO Fan 2 Way 2	42.8	3,770.4	14,749.8	12
	B-378	JO Fan 3 Way 1 & 2	42.8	3,770.4	14,749.8	12
	B-397	Last Level of Filtration Room	101.7	8,952.7	10,031.0	8
FA-MP-355	B-367	Electrical Room "THD" 1 Train 1	1,407.3	123,923.1	126,439.2	95
FA-MP-356	B-388	Electrical Room "THD" 2 Train 2	1,407.3	123,923.1	126,439.2	95
FA-MP-357	B-389	Electrical Room "THD" 3 Train 3	1,407.3	123,923.1	126,439.2	95
FA-MP-358	B-390	Electrical Room "THD" 4 Train 4	1,407.3	123,923.1	126,439.2	95

Table 7-1. MFFF Room Combustible Summary (continued)

Fire Area	Room	Room Description	MJ/m ²	BTU/ft ²	Including Transient Fire Load (BTU/ft ²)	Estimated Fire Severity (min)
FA-MP-359	B-391	Stack Release Control Room	405.0	35,660.4	46,395.8	35
FA-MP-362	B-396	Emergency Train B Electronics Room	937.0	82,507.6	93,009.7	70
FA-SR-104	D-104	Main Electrical Room Way 1	1,407.3	123,923.1	126,439.2	95
FA-SR-105	D-106	Main Electrical Room Way 2	1,407.3	123,923.1	126,439.2	95
FA-SR-106	D-107	Personnel & Material Corridor	317.6	27,964.7	30,332.9	23
	D-108	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	D-117	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
FA-SR-108	D-110	Staircase	27.6	2,426.6	7,190.9	6
FA-SR-109	D-111	Service Elevator	69.0	6,075.8	21,172.5	16
FA-SR-112	D-115	Staircase	27.6	2,426.6	7,190.9	6
FA-SR-115	D-120	Power Supply - Safety Electronic Room	937.0	82,507.6	93,009.7	70
FA-SR-116	D-121	Power Supply - Normal Electronic Room	937.0	82,507.6	93,009.7	70
FA-SR-203	D-203	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	D-204	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	D-205	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	D-206	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	D-207	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	D-208	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
FA-SR-206	D-211	Weak Currents	937.0	82,507.6	93,009.7	70
FA-SR-208	D-213	Emergency HVAC Room Train A	42.8	3,770.4	14,749.8	12
FA-SR-210	D-215	Emergency Electrical Room Train A	1,407.3	123,923.1	126,439.2	95
FA-SR-211	D-216	Emergency HVAC Room Train B	42.8	3,770.4	14,749.8	12
FA-SR-213	D-218	Emergency Electrical Room Train B	1,407.3	123,923.1	126,439.2	95

Table 7-1. MFFF Room Combustible Summary (continued)

Fire Area	Room	Room Description	MJ/m ²	BTU/m ²	Including Transient Fire Load (BTU/m ²)	Estimated Fire Severity (min)
FA-SR-301	D-301	Polishing Control Room	405.0	35,660.4	46,395.8	35
	D-332	Engineer Office				
FA-SR-302	D-302	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	D-303	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	D-305	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	D-306	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	D-315	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	D-325	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
FA-SR-303	D-304	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
FA-SR-305	D-309	Emergency HVAC Control Room Train A	405.0	35,660.4	46,395.8	35
	D-310	Emergency HVAC Control Room Train B	405.0	35,660.4	46,395.8	35
FA-SR-308	D-316	Fire Protection & Health Physics Control Room	405.0	35,660.4	46,395.8	35
FA-SR-310	D-318	Emergency Train A - Control Room	405.0	35,660.4	46,395.8	35
FA-SR-311	D-319	Emergency Train B - Control Room	405.0	35,660.4	46,395.8	35
FA-SR-312	D-320	Emergency Train A - Electronics Room Relay	937.0	82,507.6	93,009.7	70
FA-SR-313	D-321	Emergency Train B - Electronics Room Relay	937.0	82,507.6	93,009.7	70
FA-SR-314	D-322	Weak Currents - Fire Protection	937.0	82,507.6	93,009.7	70
FA-SR-315	D-323	Weak Currents - Safeguard	937.0	82,507.6	93,009.7	70
FA-SR-316	D-324	Utilities - Normal Remote Control Room	405.0	35,660.4	46,395.8	35
FA-SR-318	D-328	Utilities - Security Remote Control Room	405.0	35,660.4	46,395.8	35
FA-AP-101	C-101	Stairs	27.6	2,426.6	7,190.9	6

Table 7-1. MFFF Room Combustible Summary (continued)

Fire Area	Room	Room Description	MJ/m ²	BTU/ft ²	Including Transient Fire Load (BTU/ft ²)	Estimated Fire Severity (min)
FA-AP-106	C-106	Airlock	36.2	3,187.6	15,265.0	12
	C-107	Service Elevator	69.0	6,075.8	21,172.5	16
	C-215	Airlock	36.2	3,187.6	15,265.0	12
	C-307	Airlock	36.2	3,187.6	15,265.0	12
	C-434	Airlock	36.2	3,187.6	15,265.0	12
	C-509	Service Elevator Maintenance	69.0	6,075.8	21,172.5	16
FA-AP-108	C-109	Personnel and Materials Corridor	317.6	27,964.7	30,332.9	23
	C-110	Airlock	36.2	3,187.6	15,265.0	12
	C-111	Personnel and Materials Corridor	317.6	27,964.7	30,332.9	23
	C-113	Corridor	317.6	27,964.7	30,332.9	23
	C-114	Personnel and Materials Corridor	317.6	27,964.7	30,332.9	23
	C-117	Airlock	36.2	3,187.6	15,265.0	12
	C-127	Airlock	36.2	3,187.6	15,265.0	12
	C-142	Airlock	36.2	3,187.6	15,265.0	12
FA-AP-109	C-112	Stairs	27.6	2,426.6	7,190.9	6
FA-AP-114	C-120	Electronics Room	937.0	82,507.6	93,009.7	70
FA-AP-116	C-122	Stairs	27.6	2,426.6	7,190.9	6
FA-AP-120	C-129	Service Elevator	69.0	9,421.9	24,518.6	19
	C-425	Airlock	36.2	3,187.6	15,265.0	12
	C-524	Service Elevator Maintenance	69.0	6,075.8	21,172.5	16
FA-AP-201	C-202	Airlock	36.2	3,187.6	15,265.0	12
FA-AP-203	C-206	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-207	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-208	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-212	Airlock	36.2	3,187.6	15,265.0	12

Table 7-1. MFFF Room Combustible Summary (continued)

Fire Area	Room	Room Description	MJ/m ²	BTU/ft ²	Including Transient Fire Load (BTU/ft ²)	Estimated Fire Severity (min)
FA-AP-203 (continued)	C-220	Airlock	36.2	3,187.6	15,265.0	12
	C-236	Airlock	36.2	3,187.6	15,265.0	12
FA-AP-207	C-214	Electronics Room	937.0	82,507.6	93,009.7	70
FA-AP-213	C-222	Electronics Room	937.0	82,507.6	93,009.7	70
FA-AP-214	C-223	Electrical Room	1,407.3	123,923.1	126,439.2	95
FA-AP-220	C-231	Electrical Room	1,407.3	123,923.1	126,439.2	95
FA-AP-225	C-239	Airlock	36.2	3,187.6	15,265.0	12
FA-AP-301	C-301	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-302	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-304	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-316	Airlock	36.2	3,187.6	15,265.0	12
	C-309	Airlock	36.2	3,187.6	15,265.0	12
	C-321	Airlock	36.2	3,187.6	15,265.0	12
	C-331	Airlock	36.2	3,187.6	15,265.0	12
	C-332	Airlock	36.2	3,187.6	15,265.0	12
	C-311	Electronics Room	937.0	82,507.6	93,009.7	70
	C-312	Electrical Room	1,407.3	123,923.1	126,439.2	95
FA-AP-308	C-313	Electrical Room	1,407.3	123,923.1	126,439.2	95
FA-AP-317	C-325	Airlock	36.2	3,187.6	15,265.0	12
FA-AP-401	C-401	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-402	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-403	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-413	Corridor	317.6	27,964.7	30,332.9	23
	C-423	Airlock (MOX Access)	36.2	3,187.6	15,265.0	12
	C-426	Airlock (Access Polishing)	36.2	3,187.6	15,265.0	12

Table 7-1. MFFF Room Combustible Summary (continued)

Fire Area	Room	Room Description	MJ/m ²	BTU/ft ²	Including Transient Fire Load (BTU/ft ²)	Estimated Fire Severity (min)
FA-AP-401 (continued)	C-427	Airlock (Exit Polishing)	36.2	3,187.6	15,265.0	12
	C-412	Airlock	36.2	3,187.6	15,265.0	12
	C-417	Airlock	36.2	3,187.6	15,265.0	12
	C-419	Airlock	36.2	3,187.6	15,265.0	12
	C-424	Airlock	36.2	3,187.6	15,265.0	12
FA-AP-402	C-404	Electronics Room	937.0	82,507.6	93,009.7	70
FA-AP-410	C-414	Electronics Room	937.0	82,507.6	93,009.7	70
FA-AP-416	C-421	Electrical Room	1,407.3	123,923.1	126,439.2	95
FA-AP-418	C-428	Electrical Room	1,407.3	123,923.1	126,439.2	95
FA-AP-504	C-504	Electronics Room	937.0	82,507.6	93,009.7	70
FA-AP-505	C-505	Electronics Room	937.0	82,507.6	93,009.7	70
FA-AP-506	C-507	Electronics Room	937.0	82,507.6	93,009.7	70
FA-AP-507	C-508	Electronics Room	937.0	82,507.6	93,009.7	70
FA-AP-514	C-517	Electronics Room	937.0	82,507.6	93,009.7	70
FA-AP-517	C-520	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-521	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-525	Personnel and Material Corridor	317.6	27,964.7	30,332.9	23
	C-530	Airlock	36.2	3,187.6	15,265.0	12

Figures

This page intentionally left blank.

[THIS PAGE INTENTIONALLY LEFT BLANK.]

MFFF Construction Authorization Request
Docket No. 070-03098

Revision: 10/31/02
Page: 7-43

This page intentionally left blank.

[THIS PAGE INTENTIONALLY LEFT BLANK.]

MFFF Construction Authorization Request
Docket No. 070-03098

Revision: 10/31/02
Page: 7-45

This page intentionally left blank.

[THIS PAGE INTENTIONALLY LEFT BLANK.]

MFFF Construction Authorization Request
Docket No. 070-03098

Revision: 10/31/02
Page: 7-47

This page intentionally left blank.

[THIS PAGE INTENTIONALLY LEFT BLANK.]

MFFF Construction Authorization Request
Docket No. 070-03098

Revision: 10/31/02
Page: 7-49

This page intentionally left blank.

[THIS PAGE INTENTIONALLY LEFT BLANK.]

MFFF Construction Authorization Request
Docket No. 070-03098

Revision: 10/31/02
Page: 7-51

This page intentionally left blank.

[THIS PAGE INTENTIONALLY LEFT BLANK.]

This page intentionally left blank.

[THIS PAGE INTENTIONALLY LEFT BLANK.]

Revision: 10/31/02
Page: 7-55

MFFF Construction Authorization Request
Docket No. 070-03098

This page intentionally left blank.

[THIS PAGE INTENTIONALLY LEFT BLANK.]

Revision: 10/31/02
Page: 7-57

MFFF Construction Authorization Request
Docket No. 070-03098

This page intentionally left blank.

[THIS PAGE INTENTIONALLY LEFT BLANK.]

MFFF Construction Authorization Request
Docket No. 070-03098

Revision: 10/31/02
Page: 7-59

This page intentionally left blank.

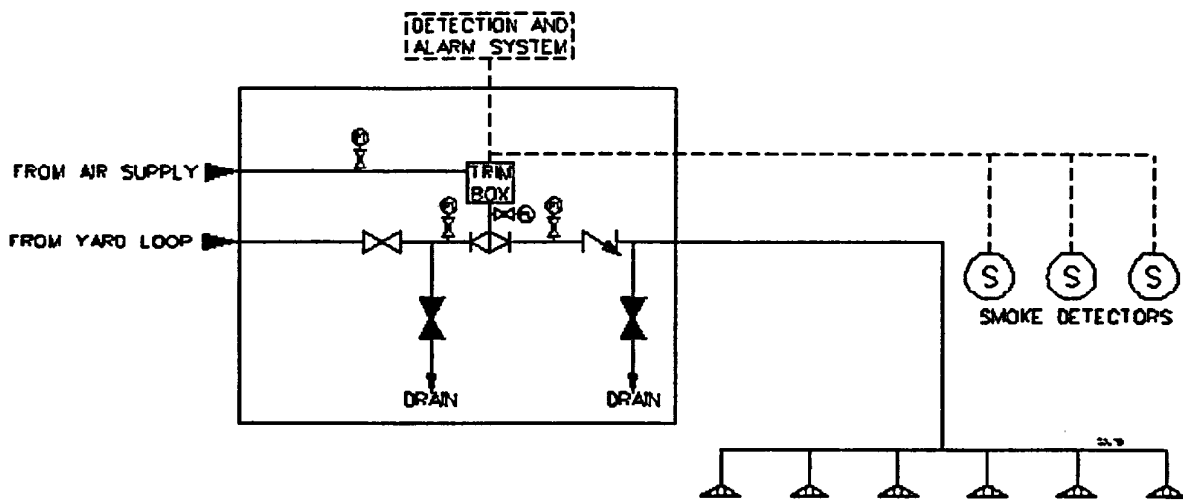


Figure 7-9. Preaction Sprinkler System

This page intentionally left blank.

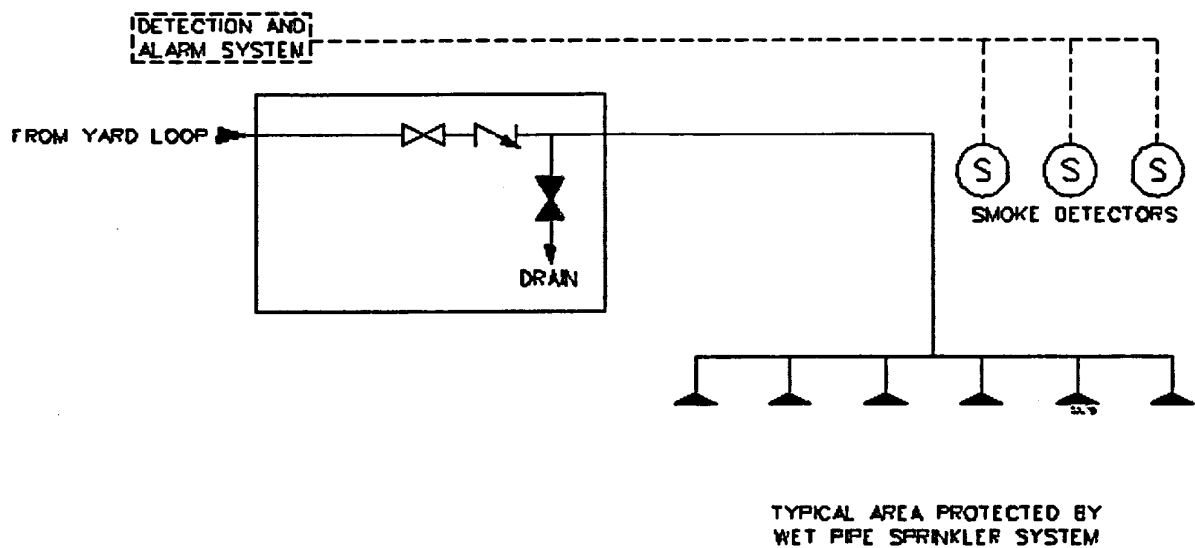


Figure 7-10. Wet-Pipe Sprinkler System

This page intentionally left blank.

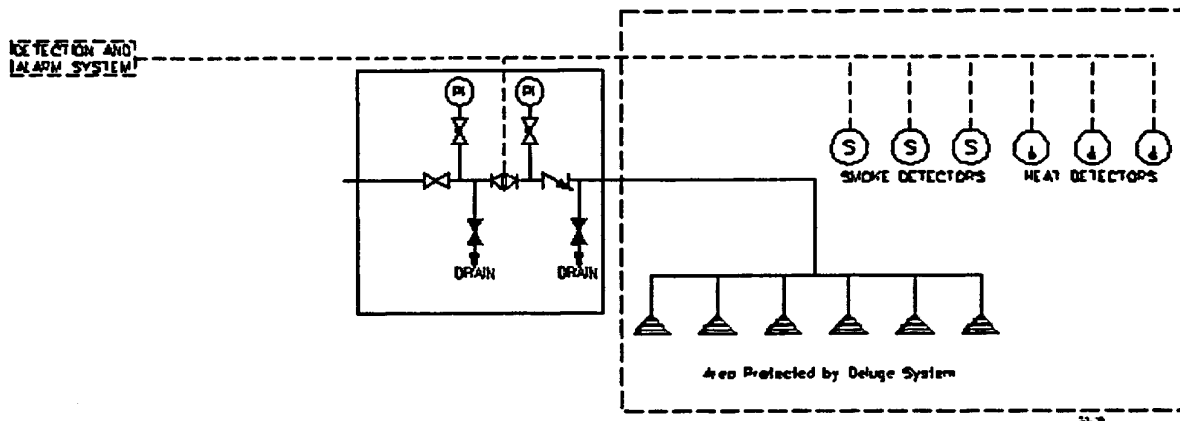


Figure 7-11. Deluge Sprinkler System

This page intentionally left blank.

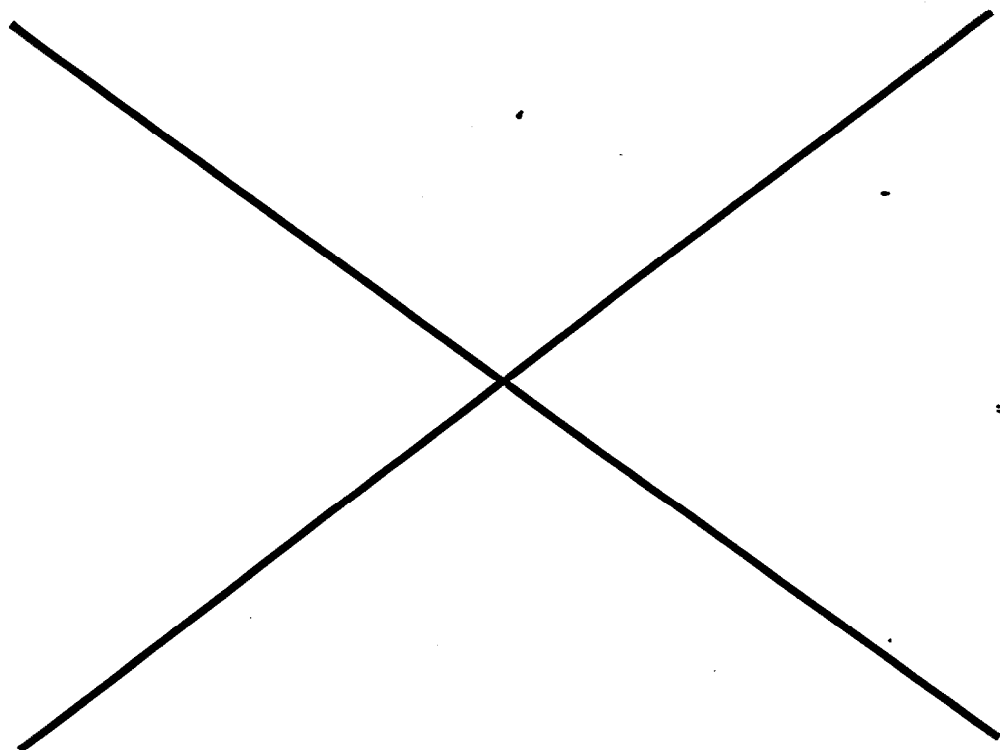


Figure 7-12. Carbon Dioxide Systems – Deleted

This page intentionally left blank.

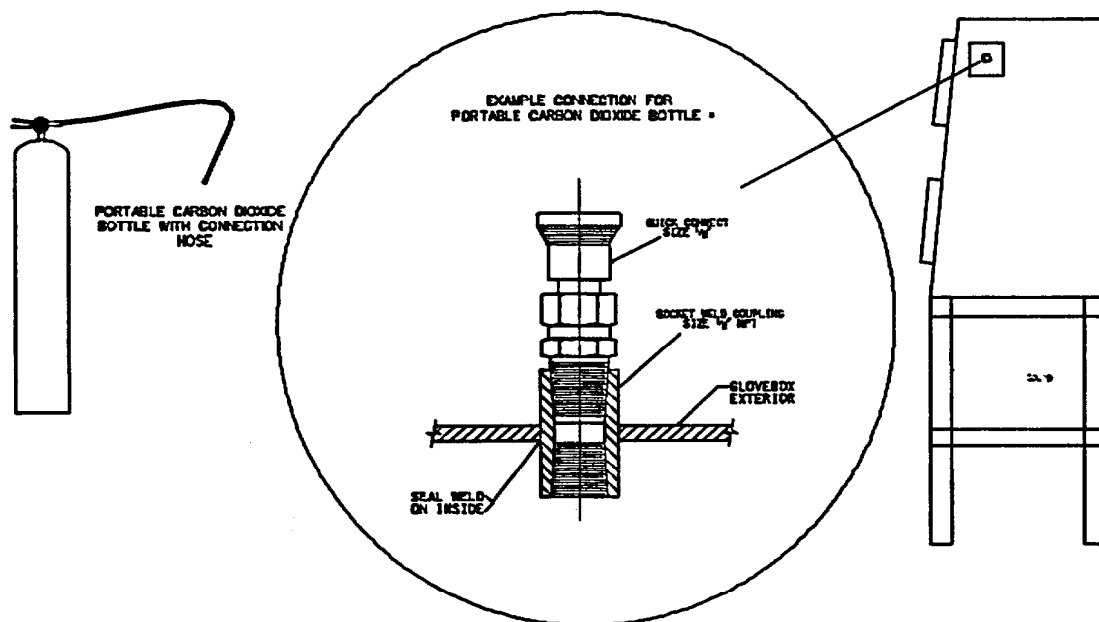


Figure 7-13. Carbon Dioxide Systems – Portable CO₂ System for Glovebox

This page intentionally left blank.

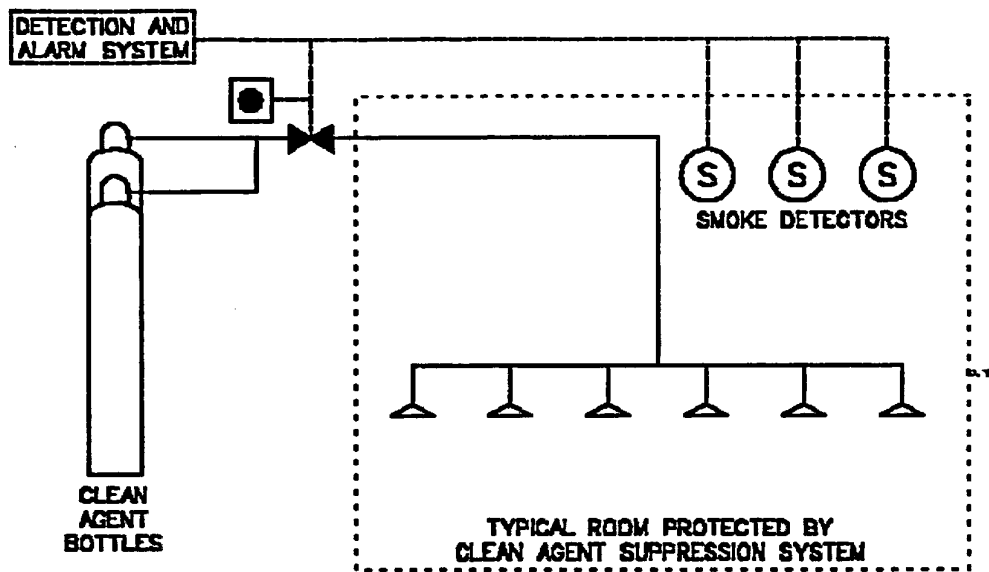


Figure 7-14. Clean Agent System

This page intentionally left blank.

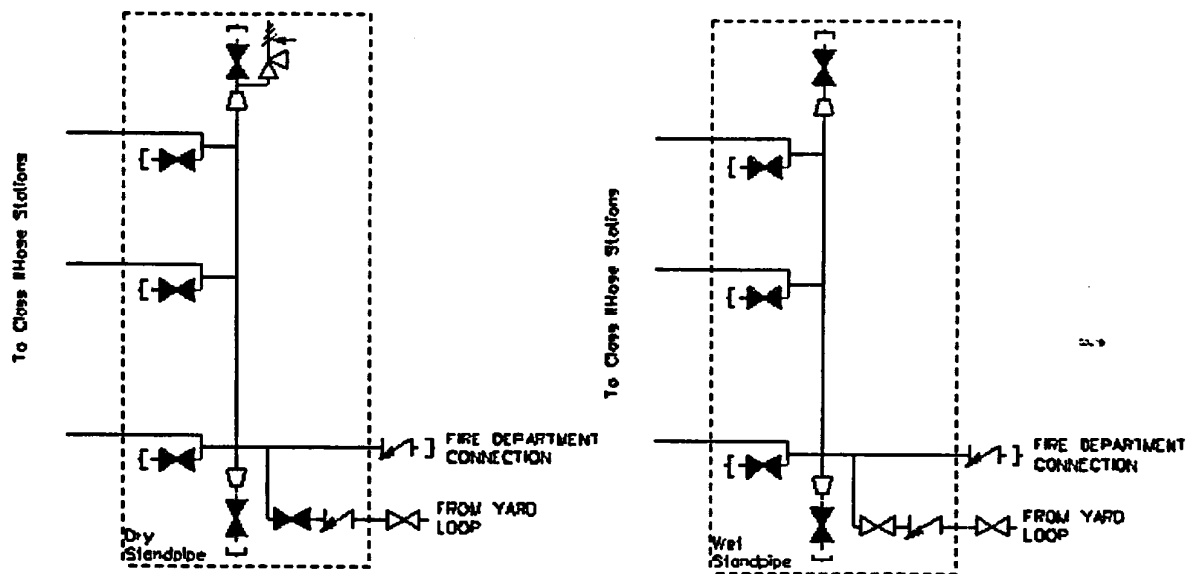


Figure 7-15. Standpipe System

This page intentionally left blank.

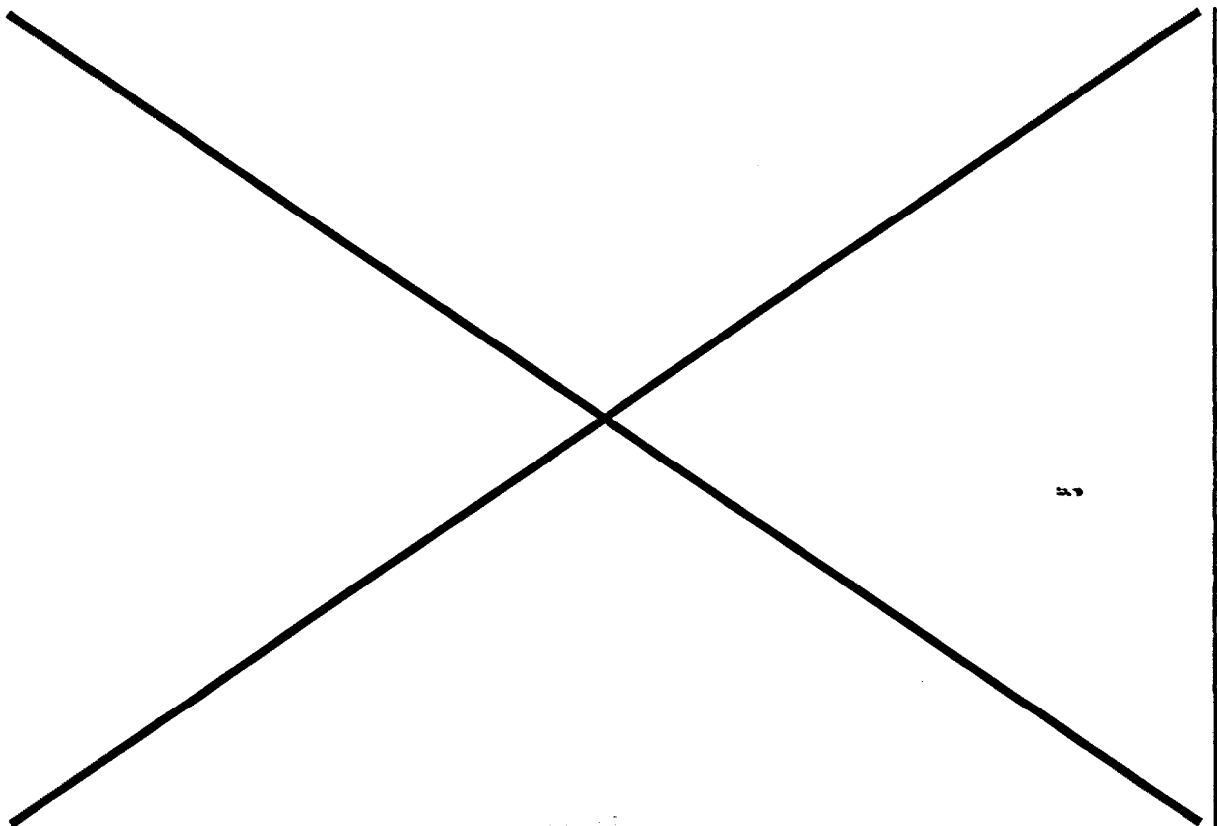


Figure 7-16. Deleted (Combined with Figure 7-1)

This page intentionally left blank.

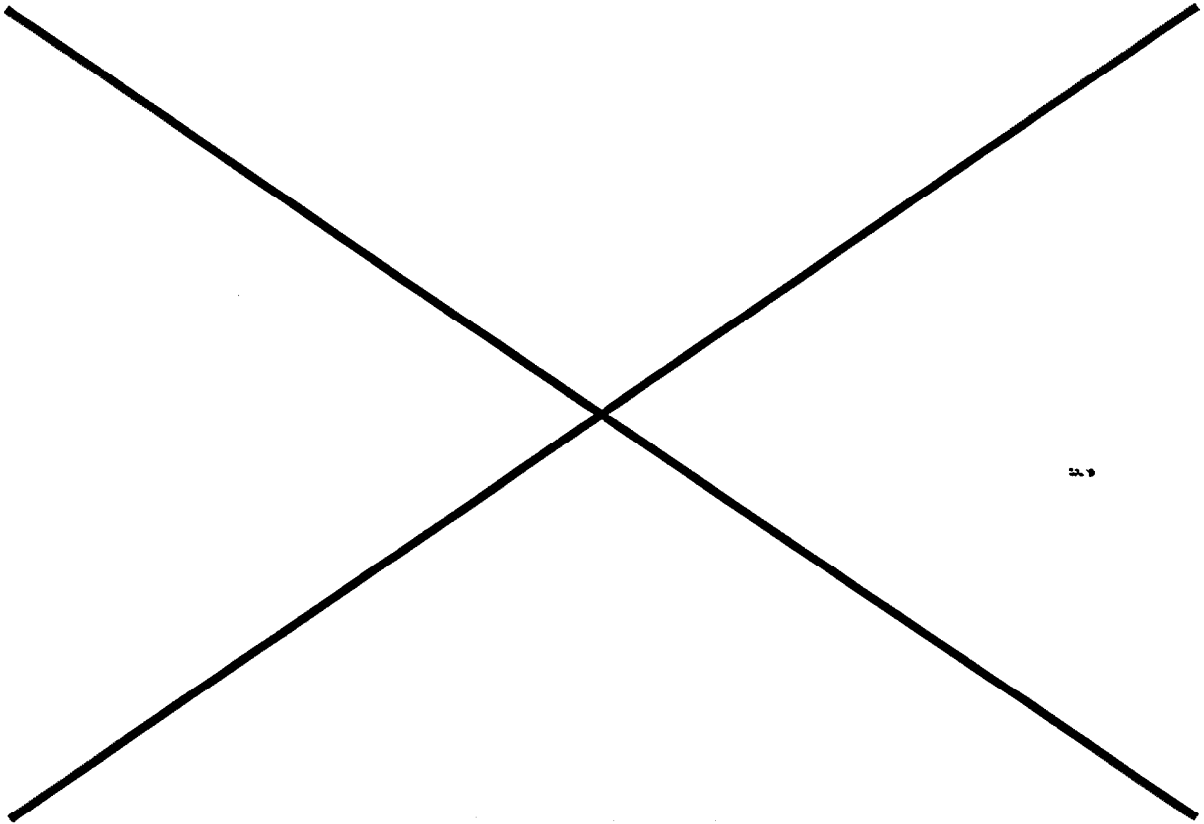


Figure 7-17. Deleted (Combined with Figure 7-2)

This page intentionally left blank.

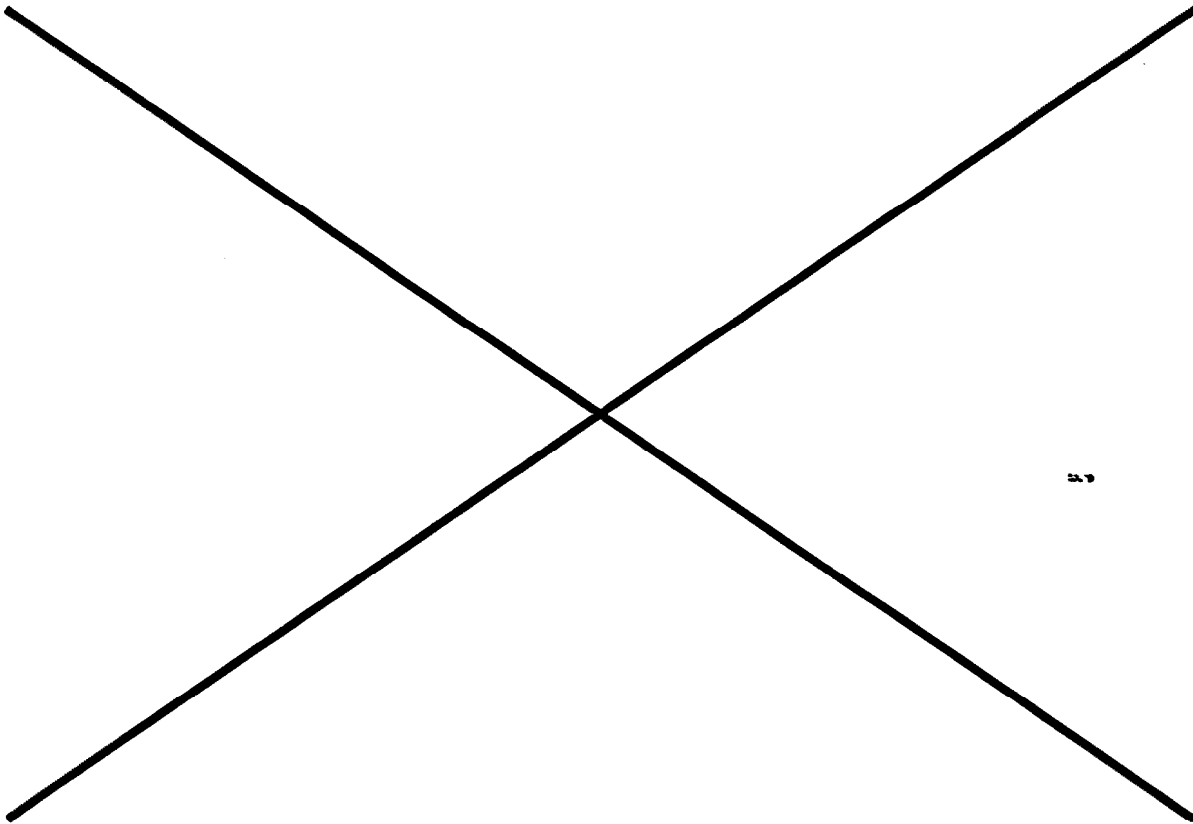


Figure 7-18. Deleted (Combined with Figure 7-3)

This page intentionally left blank.

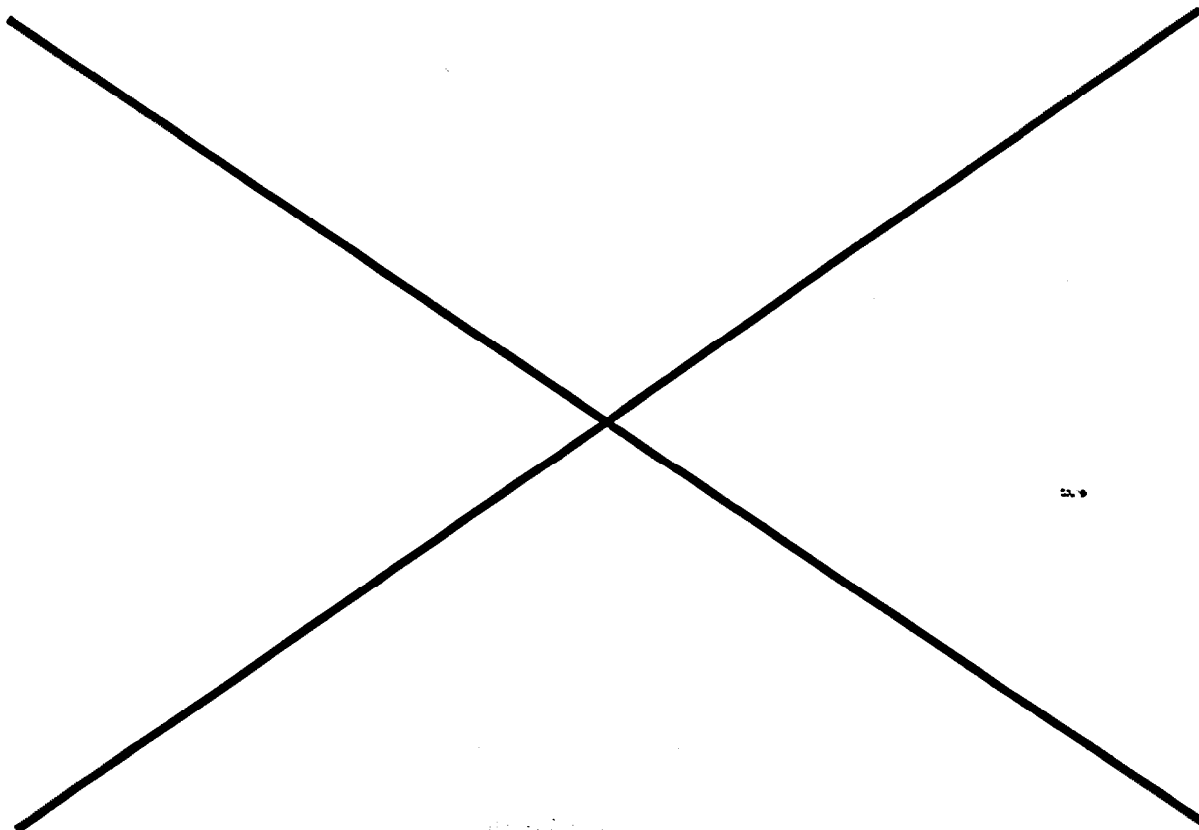


Figure 7-19. Deleted (Combined with Figure 7-4)

This page intentionally left blank.

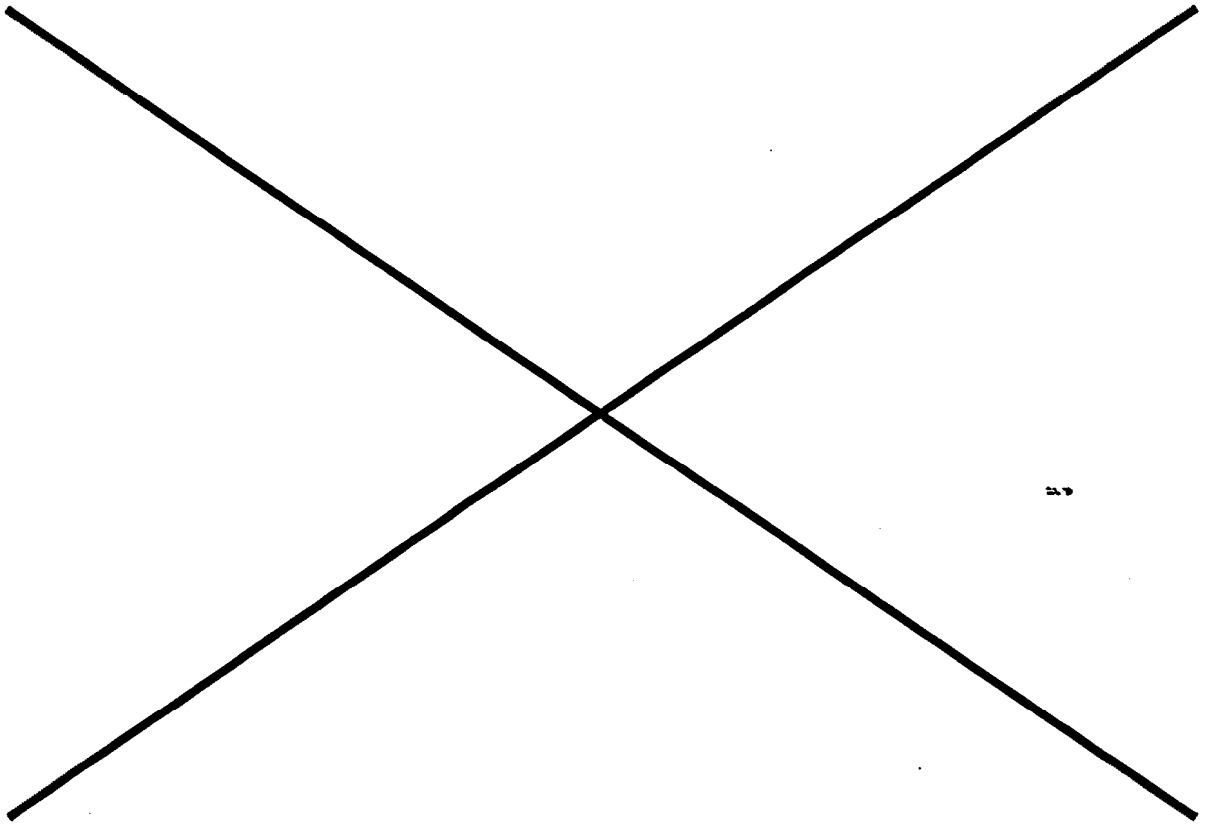


Figure 7-20. Deleted (Combined with Figure 7-5)

This page intentionally left blank.

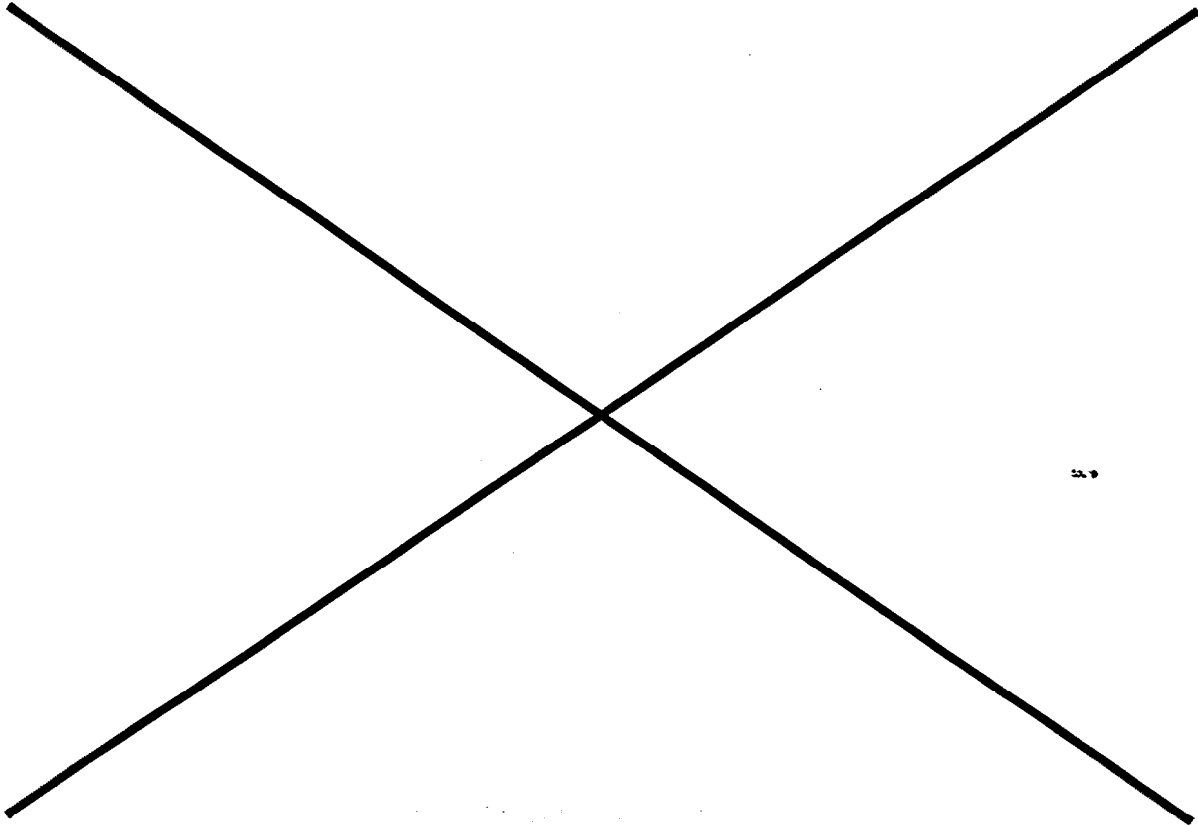


Figure 7-21. Deleted (Combined with Figure 7-6)

This page intentionally left blank.

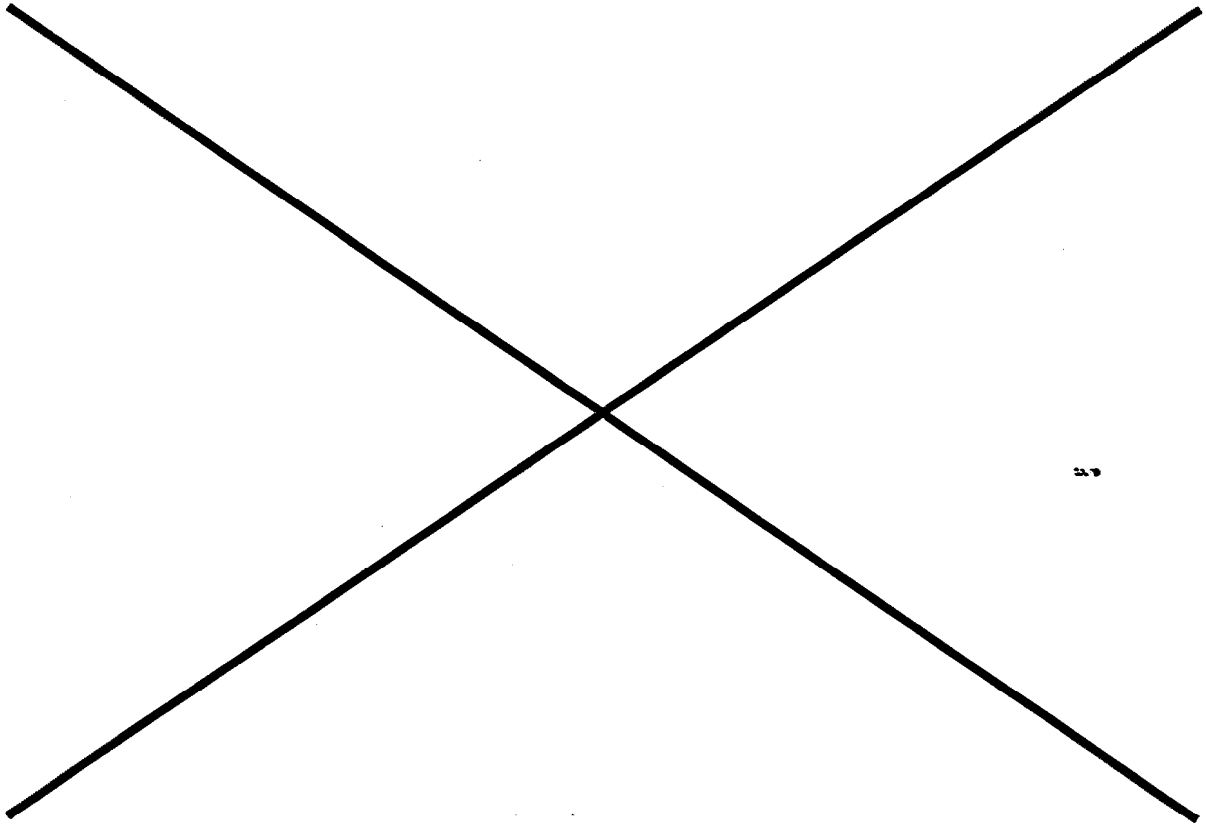


Figure 7-22. Deleted (Combined with Figure 7-7)

This page intentionally left blank.

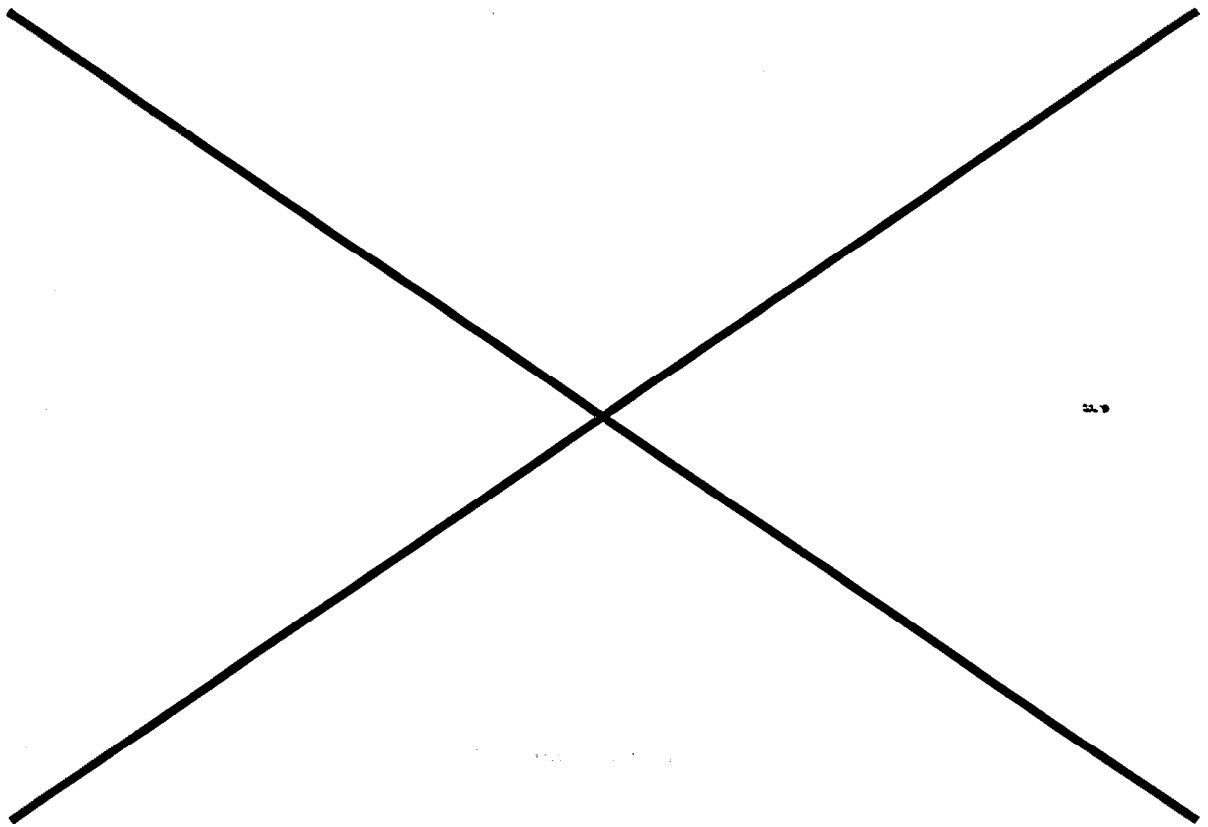


Figure 7-23. Deleted (Combined with Figure 7-8)

This page intentionally left blank.

This page intentionally left blank.

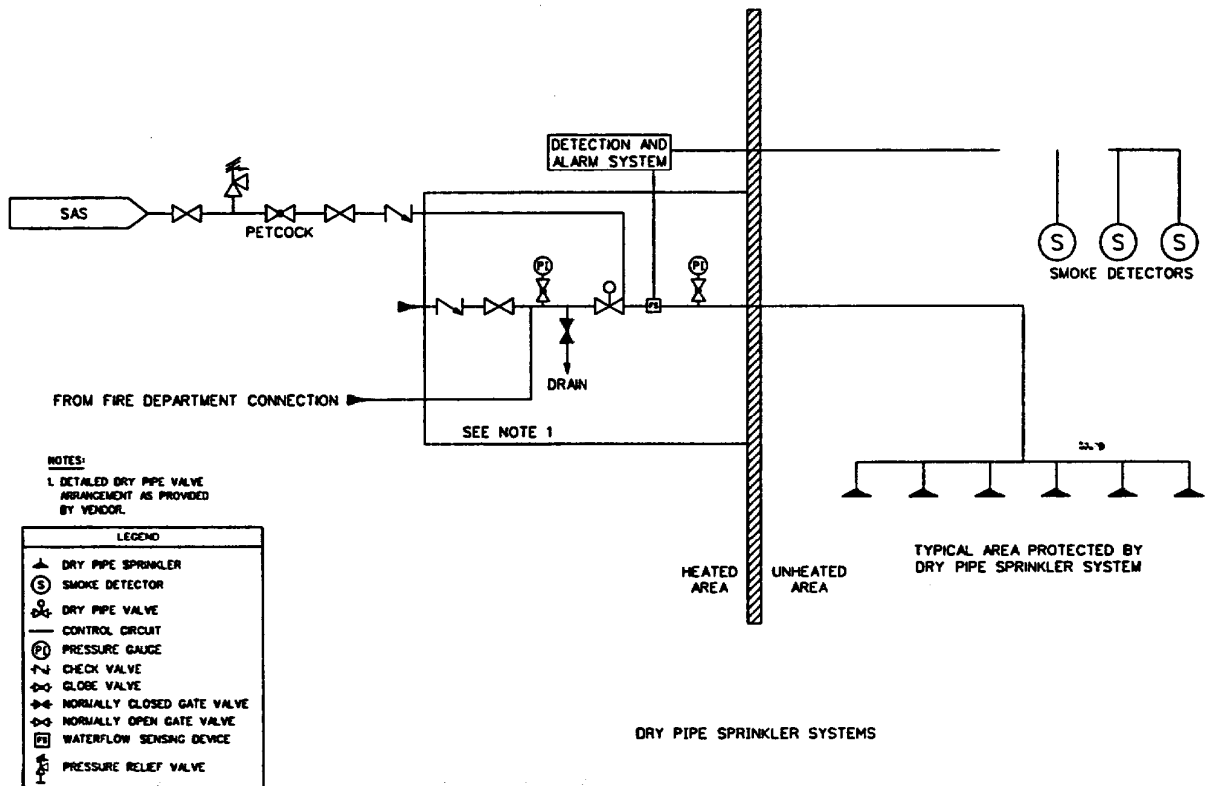


Figure 7-25 – Dry Pipe Sprinkler Systems

This page intentionally left blank.